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**PHILIPPO BLUADAMANTI & P. MARINON** (see 1978, *Journal of Neurological Sciences*)  
**WALTER CAPTANI & P. MARINON** (see 1978, *Journal of Neurological Sciences*)

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## SEARCH AND RESCUE OPERATION



Medical Officer on double lift system, hoisting into the rescue helicopter a survivor of a factory ship with complete heart block following 2nd coronary. Also dug up to facilitate further IV work as required. Patient returned to operations this morning. 26

## Editorial

*And if ever an occasion happened I have let the moment of expression slip by I have become incapable of putting down what I wanted to say in my manuscript and the manuscript has become a blur and will soon — C. E. M. Skellam*

To those who have not lived the joys of fly fishing, or the allied pleasures of water dogs or its extensive literature, there may not be known the method suggested and recorded observations over 50 years of fishing the upper lakes are as sharp as brass to all. He claimed never to have written a book<sup>1</sup>, merely collections of ephemeral jottings, some of which have recently been reprinted.<sup>2</sup> Few will possess Skellam's skill and dedication to observation and recording, but his techniques are useful for the speaker, the general practitioner or those at research. It is wonderful to read what the lake was sharp and clear, and desirable to publish and report observations of value and these passages are as true today as in the past.

We are told that progress in modern medicine is led by a series of unrecorded processes but most of the present understanding are the result of its success. The recent technical advances, whereby

nearly everything is possible if it is considered worth while, have opened an era of automation which, for the first time, contains the possibility of real care for many diseases, and the prevention of others. Regrettably this power of man has emphasized the vast importance of precise and accurate diagnosis and the practice of diagnosis has become largely scientific and intellectual. For some the practice of medicine has become an intellectual game concerned not with the patient but his disease, particularly if it is not curable.

But medicine involves care as well as cure. Like objects under observation, the designer of history taking, examination and surgery, in losing these skills and attributes specialist doctors are losing the skills by which they can establish rapport with their patients. Without such rapport how can care be given any good? It cannot be replaced by the de-procedure or organized social system or even in many cases by the machine itself — remote monitoring, a monitor and part of a nursing management unit which seldom achieves the intimate personal contact of a Ward. Nothing can replace personal contact conducted in the spirit of Asclepiades.<sup>3</sup> We need to return the human doctor now found expensive and knowledge.

If the efficiency and complexity of care has led to a neglect of care, its expenses have accentuated the economic pressures on medical to decide its priorities in the use of necessarily limited resources both of material and personal. Inevitable measures which

1. A. Skellam, *Notes of the Chalk Stream 1897-1926* (Oxford).

2. *Ways of a Trout and the Fly Fish* (Penguin 1966).

3. The Chalk Stream Angler — Selection, highlights and bibliography 1922 — Skellam Fly Fishing 'Widow' (1977).

In the wider context of mass agreement to the DHESS the priorities of prevention and treatment of musculoskeletal occupational health and the balance between speed and general practitioner care are under review.<sup>4</sup> The NAPP and<sup>5</sup> has not been questioned by *The Way Forward*.<sup>6</sup> Do we need to centralise and speed the faster more widely and is this current for not overly with its rapidly advancing technology?

It would be a pity if the moment of repentance be attempted to involve these adventures alone and

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## Adult Intussusception due to Duplication of the Duodenum

A. C. Barth and R. L. Adkins

### ABSTRACT

*Intussusception in the adult is a neglected entity. In the majority of cases a lesion within or adjacent to the bowel usually explains its affected's presentation in the abdominal pain. A case of this rare entity occurring in an adult due to duplication of the duodenum is described. Only 1 similar case has previously been reported in the literature. The entity requires a clinical, clinical and radiological approach and finally discussed.*

### Introduction

Intussusception, primarily a disease of infants and children, is surprisingly rare in adults, in whom the condition is usually secondary to some other lesion in the bowel (Dunkley & Kelly 1958; Sanders, Hagen & Korman 1958; Reed & Roberts 1961). A case of intussusception in an adult due to a duplication of the duodenum is reported.

### Case Report

A 35 M, aged 28 years was admitted as an emergency to the Royal Naval Hospital Malta, on June 15 1975, with a 3 day history of colicky abdominal pain, vomiting, diarrhoea and loss of appetite. Since her arrival in Malta from Britain 4 months previously she had experienced intermittent attacks of increasing distended pain lasting 2 to 3 hours and coming with a loss of diarrhoea. Prior to this she denied any abdominal or gastrointestinal symptoms apart from a tendency towards constipation.

Physical examination on admission revealed a thin young woman. She did not

appear to be distressed. Blood pressure 120/80 mm. Hg, pulse 72/min, temperature 37.4°C. The tongue was moist and coated and there was no hoarse. A smooth firm oval mass, 15 cm x 12 cm was present in the right para umbilical region. The mass was movable in a diagonal plane from the right hypochondrium towards the left thor. fossa and was moderately tender along the right border. There was mild distension of the lower abdomen with slightly hyperactive bowel sounds. There was no rebound tenderness or guarding. Rectal examination was negative.

Investigations included anaemia normal haemoglobin 13.2 gms/l, Hb 7.500 mm<sup>3</sup>, ESR 25 mm in the first hour (Wassermann) blood urea and electrolytes normal. Abdominal X-ray of the abdomen showed distended loops of small bowel displaced towards the left half of the abdomen by a soft tissue shadow on the right side (Fig. 1). Treatment with metoclopramide 10 mg and electrolytes was commenced. The following day the patient was free from symptoms and the abdominal mass could not be felt. On June 17, intermittent cramp like abdominal pains returned, becoming progressively worse and the mass was again palpable on the right side of the abdomen. The patient passed a loose stool together with profuse watery jelly like material.

A diagnosis of intussusception was made



Fig. 1 Draped view of the abdominal cavity (no air) showing right liver displaced upwards and left half of liver displaced downwards.

and emergency laparotomy performed. At operation an ileo-caeco colic mass resection was found to be present, the apex of the intussusception was at the level of the hepatic flexum and the ileum passed in the intussusception was moderately dilated. On reducing the intussusception, the cause was found to be a solid, knuckle-like projection arising from the antimesenteric aspect of the terminal ileum approximately 3 centimetres from the ileo-caecal junction. The terminal ileum and caecum appeared thickened and oedematous. The ileum was carried along with the caecum, appendix and a portion of the terminal ileum and ascending colon. An end-to-end anastomosis was performed. The patient made an uneventful recovery, had a normal bowel action on the fifth day after operation and was discharged from

hospital on June 26, 1973.

The excised specimen consisted of the caecum, appendix and ileum which were spread apart from some sections of the wall (Fig. 2(a) and (b)). Three cross-sections



Fig. 2 (a) and (b) the excised specimen (a) a cross-section of the caecum, appendix and 10 cm of ileum. The ileum entered at the terminal ileum (diameter 1.5 cm) in diameter and was anteriorly fixed with the wall of the caecum.

(b) the 'spine of' non-permeanting duplication projected into thickness of the ileum with evidence of the underlying mucosa. On running a strip, the strip was found to be joined with about 20% extra-ileal material.

from the ileocecal valve, a roughly spherical cyst 2.5 cm in diameter was present in the wall of the ileum, projecting into the lumen of the bowel from the antimesenteric border. Dissection revealed a common wall between the cyst and the adjacent intestine. The contents of the cyst were thick, grey and clay like in consistency. Macroscopic examination established that the lesion lay in the submucosa of the ileum, most of the mucosa passing externally with a thin layer of smooth muscle between the distal ileum and the lumen of the cyst. The distal ileum was inflamed and ulcerated and the mucosal masses appeared to be hyperplastic. The lumen of the cyst contained a simple type of intestinal mucosa with an underlying mucosa propria (Fig. 2). The submucosal glands contained vegetative cells and numerous

goblet cells and many were detached by mucus. Villi were lacking, but the presence of Paneth cells which are not found in normal large bowel suggested a simple form of small intestinal mucosa. On the basis of these findings the lesion was considered to be a spherical, non-communicating duplication of the ileum.

#### Discussion

Intussusception is rarely considered as a diagnosis in adult patients with acute abdominal symptoms. Adults account for less than 10 per cent of all cases of intussusception and in 50 per cent of these the intussusception is initiated by a primary lesion in the bowel (Donohue & Kelly, 1958; Boyton & Woods, 1958; Sanders *et al.*, 1958; Bond & Roberts, 1964). A benign tumour or a Meckel's diverticulum is the most common cause of small bowel



Fig. 2. The internal lining of the duplication diverticulum (H&E) and presence of submucosal glands and numerous goblet cells. Lumen is separated by a narrow layer of smooth muscle from the inflamed distal ileum (magnification  $\times 100$ ).

intussusception while two thirds of large bowel intussusceptions are due to a malignant lesion (Doddsworth & Kelly, 1962; Halseworth, Thompson, McCoy, 1965; Sanders *et al.*, 1964). The incidence of idiopathic intussusception in adults is said to be higher in some African communities (Karl & Rundle 1962; Cole, 1962). The symptoms and signs of intussusception in the adult differ from those as well recognized in infants. Whereas in infants intussusception is an acute illness characterized by sudden severe colicky abdominal pain, vomiting, blood and mucus in the stool and a palpable sausage-shaped abdominal tumour, a 50 per cent of patients (Swenson & Grossmanopoulos, 1962) most adult cases present as subacute or chronic intestinal obstruction with vague and ill defined symptoms for periods varying from days to years (Brown & Michels, 1952). Rectal bleeding occurs in only a third of cases and an abdominal mass is less than half while the underlying cause escapes diagnosis until an acute episode leads to laparotomy (Mayton & Wynn, 1954; Sanders *et al.*, 1964; Smith & Gillespie, 1964). However, the detection of a disappearing tumour present on one occasion and absent at the next, should raise suspicion of the diagnosis (Bond & Roberts, 1964). In our case a pre-operative diagnosis of intussusception was made on the basis of the clinical signs and the straight X-ray examination of the abdomen. Bond & Roberts (1964) have indicated the value of the straight X-ray of the abdomen in the diagnosis of intussusception. This may demonstrate the presence of obstruction, the 'leopard-skin' sausage-shaped shadow of the intussusception and occasionally the 'target' at its apex.

Tubular or spherical tumours attached to some part of the alimentary tract and closely resembling it in its gross and microscopic appearance are properly termed duplications (Ladd & Gross, 1940).

In the past these lesions have variously been described as enterocystomas, giant diverticula, and enterogastric cysts. They are an uncommon group of developmental abnormalities which may be related in any part of the alimentary tract from the oesophagus to the anus and occur most frequently on the mesenteric aspect of the bowel (Sternowitz, Calk & Rans, 1948; LaFrentz, Kaufman & Harshfield, 1950; Gross, Hakomb & Faber, 1952). Tubular duplications usually communicate with the lumen of the bowel and are often lined with heterotopic gastric mucosa (Macdonald & Mansueti, 1955; Wren, 1962; Rao, DeLoren, Koss & Montgomery, 1965). There is lack of clear explanation for the origin of intestinal duplications. However, defective recanalization of the original solid intestinal tube in the 4 week old embryo appears to be the most plausible theory (Singer, 1940). Duplications present clinically for the most part during infancy and early childhood and give rise to symptoms and signs that are so vague that the diagnosis is usually established either at operation or at autopsy (Gross *et al.*, 1952; Holm & Jan, 1955; Macdonald & Mansueti, 1955; Anderson, Silberman & Shewell, 1958). In adults, duplications are responsible for intussusception in 0.3 per cent of cases (Ovali 1956; Sanders *et al.*, 1964).

The true incidence of duplications in adults is unknown. Anderson *et al.* (1958) collected 43 cases of adult duplication at all levels from the oesophagus. Since then a further case of dual duplications in an adult has been reported (Duffy, Marquis & Watson, 1974). In a search of the literature we were able to find only 3 previously reported cases of adult intussusception secondary to duplication (Doddsworth & Kelly, 1962) reviewed 460 cases of adult intussusception and an enterocystoma was cited as the cause in one case. Cummings (1953) described a case of obscure colic intussusception due to a spherical



duplication of the ileo-caecal junction. Nelson & Lee (1953) reported a case of double ileo-intussusception due to a small spherical duplication arising from the antimesenteric surface of the ileum.

The case we have reported is another example of this unusual combination of variants where the gross operative diagnosis of intussusception was possible owing to the fortuitous presence of clinical signs which occurred together in the adult. However, the underlying duplication was only revealed at operation.

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## Timed Trimester Amniocentesis using a Short Needle: An Assessment of its Safety and Value in Cases of Doubtful Dates

M. L. Bellows, C.J. Orchard and M. A. Tetterside

### ABSTRACT

In a case where ultrasound findings 20-24 cm amniocentesis were performed on 100 patients were in period of first trimester to obtain an accurate date by analysis of the chorionic villi. They were carried out on an uncomplicated basis using a short needle. There were no complications.

The results obtained allowed the prediction of foetal week age, which could be predicted to a confidence level that was equivalent to that of the chorionic villi. This was a pilot study to assess the value of a short needle in cases of doubtful dates.

### Introduction

Precise delivery is dangerous to babies. Both *et al* (1976) calculated that it accounted for 85 per cent of all early neonatal deaths not due to foetal congenital defects. They quoted a mortality of 34.3 per 1 000 at 32-33 weeks gestation and 21.6 per 1 000 at 34-35 weeks.

A leading article in the British Medical Journal (1976) stated that respiratory distress was the major cause of death in premature babies, with an incidence of 10 per cent, and a mortality of 30 per cent, although Jones and Parkington (1977) reported a mortality of only 77 per cent.

A case cytophotometry affords the most accurate estimate of foetal maturity when data about dates occur. Foetal lung maturity can be estimated by the lecithin/sphingomyelin ratio as measured from the amniotic fluid. The 'stake' test and its correlation with the lecithin/sphingomyelin ratio has been fully investigated and discussed by Clements *et al* (1975), Wiggall and Bramham (1975), Parkington and Murray (1975), Rappaport *et al* (1975), Rappaport

*et al* (1975) and Mukherjee *et al* (1976) concluded that it remains a useful screening test for foetal lung maturity when one suspects maldevelopment of perinatal age.

This test requires amniocentesis for its performance. Reports on the hazards of amniocentesis are common. However, they are all associated with the use of a spinal needle usually inserted at a high site. The British Medical Journal in a leader (1975) discussed the techniques and risks of amniocentesis in late pregnancy and mentioned the use of a short needle in these patients.

This paper gives an assessment of the exclusive use of a short needle for third trimester amniocentesis in order to evaluate foetal lung maturity by the stake test.

### Patient and Methods

From April 1975 records were kept of amniocentesis performed at British Midway Hospital, Huddersfield. These data for British Midway Hospital were not included in this paper, there was no foetal run or neonatal morbidity among them.

During the period of the survey that was dependent on a local German hospital for ultrasound investigations. It was only available the use of the service was very high, and it was used infrequently. We have never been equipped with a Gonioscope Mark II (Parker Teleports).

Amniocentesis was performed on patients when it was considered should be delivered but whose dates were uncertain. Informal

consent was obtained. Gravid obese patients and those with allopurinolism were excluded. After the patient's bladder was emptied, the fetal heart was monitored and the presenting part disimpacted if possible. The vaginae of nulliparous women were used, the breech being preferred. The skin was cleaned with a 'Mideclore' (povidone-iodine 10 per cent isopropyl alcohol — Pharmacia Ltd) and a disposable 38 mm by 0.6 mm (2½ by 3½ inches) needle attached to a 2 ml syringe was introduced as far as it felt in a quick stabbing movement. No local anaesthetic was used. If blood was withdrawn, the needle was removed and another stab given after repositioning the fetal head. If neither liquor nor blood was withdrawing a further attempt was made. The procedure ceased with discomfort, and no repeat attempts were made. No special observation was made other than the routine administration of 4 ml of chloramphenicol to Rh-negative pregnant blood had been ascertained. Liquor was subjected to the 'shaker' test described by Clements *et al* (1971), as modified by Sprinkle *et al* (1974). (To a 4.5 ml aliquot of liquor 0.5 ml of normal saline are added in a plain glass tube. 1 ml of 10 per cent cold alcohol is added and the tube shaken for 15 seconds. It is now left to stand vertically for 15 minutes. A complete ring of bubbles at the liquid-air interface indicates a mature test. No bubbles indicate an immature result. Negative results were not subjected to chromatography. In patients with negative results the pregnancies were allowed to continue. Dry and bloody rags were considered to be of no value, and the speed of labour was paid to the labour.

All babies, placenta and cord were examined immediately after delivery. The babies were managed normally. Respiratory distress syndrome was diagnosed if two of the criteria described by Forlar and Arnold (1973) were present. The criteria described were: (i) respiratory rate over 60/min; (ii)

expiratory grunting; (3) nasal recession and (4) cyanosis out of oxygen.

Results were analysed by two-tailed Student's *t* test, or by  $\chi^2$  with Yates' correction as appropriate.

# Results

Data derived from 115 attempted amniocentesis are shown in table 1.

The interval between the last unsuccessful attempt and delivery was noted. Comparisons were made of the results of the attempts with this delivery interval (table 2).

The incidence of clinical fetal distress in labour was compared between patients who had successful amniocentesis with those who had not (table 3).

The changing pattern of respiratory distress of the newborn in this hospital from 1974 to 1979 is shown in table 4.

# Discussion

There is no place for blind amniocentesis where ultrasound facilities are available. There must be strong suspicion, however, both in the United Kingdom and in developing countries, which do not have this equipment. It is often there very early because of large infant mortality rates and a high incidence of obstetric risk problems, which have to face the greatest problems with both the assessment of foetal well-being and labour.

Respiratory distress is the prime killer of pre-term babies. It was felt reasonable to use a measure of foetal lung maturity as an aid to timing the delivery. The known false negative results of the 'shaker' test were accepted as a safety margin. It is a simple test and involves no laboratory work.

The method of amniocentesis described is not difficult. It requires no more equipment than that needed to perform a caesarean. In this respect was safe and the use of the needle combined with the use of gloves may have avoided catastrophic results.

Table 1

Signs reported from *echinoparasitosis* (n=100)

Signs reported from <i>echinoparasitosis</i> (n=100)	First	Second	Third	Fourth and more	Total number of patients reported
Foetulant 'stinks' test	15	13	6	3	36
Regalious 'stinks' test	15	8	7	1	31
Dry tap	10	11	8	1	30
Bloody tap	17	11	2	5	35
Total number of patients (not test)	117 (100)	51 (43.5)	31 (26.4)	11 (9.4)	209

Table 2

Comparison of those with early infection, &lt; 10 days from onset, with those with late infection, &gt; 10 days

Signs	n	Mean duration of infection (n=27)
Regalious 'stinks' test	14	1.48 (s.d. 0.84)
Foetulant 'stinks' test	16	1.75 (s.d. 0.74)
Dry tap	14	1.79 (s.d. 0.70)

Calculations:

$$\frac{1.48}{1.75} = 0.84$$

$$\frac{1.79}{1.75} = 1.02$$

$$t = 0.01$$

as those recorded by Ryan *et al.* (1971), Kordon and Bernanque (1972) and Hyman *et al.* (1973). Liquor was essentially abnormal in 50.2 per cent of the cases. It was found that ascending epidemics was related to increasing severity—

Table 3

Comparison of the effect on foetal development in the first trimester of those with early infection, &lt; 10 days, or those with late infection, &gt; 10 days

	Early infection, < 10 days	Late infection, > 10 days	n	p
Not lost or abortion	10	10	20	0.1
Still born or foetus	7	15	22	0.1

There was a highly significant increase in the duration of pregnancy in those patients who had a negative 'stinks' test when compared with those with positive tests and with the foetuses. None of these babies came to any harm by prolonging the pregnancy, but may have done so had they been delivered at the time of the first miscarriage. There was no significant

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Year	As a percentage of Gross Domestic Product	Change in real Gross Domestic Product
1980	1.0	1.0
1985	0.9	2.0
1990	0.8	1.0

[illegible]

difference between the delivery intervals of the patients with positive tests and those with failed attempts. It is possible that the failure rate may increase with increasing gestational maturity because of the larger baby and relatively less liquor.

Unlike Rame et al (1994), no relationship could be shown between total arrhythmias and subsequent total strokes as defined (as determined by continuous focal heart monitoring). It has been suggested (British Medical Journal, 1994) that when the procedure has failed in 1st degree no repeat — our results did not agree with this.

Like many other units worldwide, our incidence of respiratory distress syndrome has decreased significantly in recent years. This may be a natural phenomenon or may be related to the use of surfactants in the intubated neonates of at-risk mothers. The decreasing mortality may be due to a reduction in the severity of the condition or to improved medical care.

Many observations make a combination of chemical and scientific tests to determine when to deliver a patient when these are not available. A case explanation is undoubtedly the most accurate when the operation is represented in detail without the facility. It is suggested that the procedure described should be considered as a value alternative to other long-term assessments or delivery without adequate knowledge of clinical aspects.

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 1977k *Brain Res.* **102**, 303-306, compared with  
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 1977q *Brain Res.* **102**, 327-330, compared with  
 1977r *Brain Res.* **102**, 331-334, compared with  
 1977s *Brain Res.* **102**, 335-338, compared with  
 1977t *Brain Res.* **102**, 339-342, compared with  
 1977u *Brain Res.* **102**, 343-346, compared with  
 1977v *Brain Res.* **102**, 347-350, compared with  
 1977w *Brain Res.* **102**, 351-354, compared with  
 1977x *Brain Res.* **102**, 355-358, compared with  
 1977y *Brain Res.* **102**, 359-362, compared with  
 1977z *Brain Res.* **102**, 363-366, compared with  
 1978a *Brain Res.* **102**, 367-370, compared with  
 1978b *Brain Res.* **102**, 371-374, compared with  
 1978c *Brain Res.* **102**, 375-378, compared with  
 1978d *Brain Res.* **102**, 379-382, compared with  
 1978e *Brain Res.* **102**, 383-386, compared with  
 1978f *Brain Res.* **102**, 387-390, compared with  
 1978g *Brain Res.* **102**, 391-394, compared with  
 1978h *Brain Res.* **102**, 395-398, compared with  
 1978i *Brain Res.* **102**, 399-402, compared with  
 1978j *Brain Res.* **102**, 403-406, compared with  
 1978k *Brain Res.* **102**, 407-410, compared with  
 1978l *Brain Res.* **102**, 411-414, compared with  
 1978m *Brain Res.* **102**, 415-418, compared with  
 1978n *Brain Res.* **102**, 419-422, compared with  
 1978o *Brain Res.* **102**, 423-426, compared with  
 1978p *Brain Res.* **102**, 427-430, compared with  
 1978q *Brain Res.* **102**, 431-434, compared with  
 1978r *Brain Res.* **102**, 435-438, compared with  
 1978s *Brain Res.* **102**, 439-442, compared with  
 1978t *Brain Res.* **102**, 443-446, compared with  
 1978u *Brain Res.* **102**, 447-450, compared with  
 1978v *Brain Res.* **102**, 451-454, compared with  
 1978w *Brain Res.* **102**, 455-458, compared with  
 1978x *Brain Res.* **102**, 459-462, compared with  
 1978y *Brain Res.* **102**, 463-466, compared with  
 1978z *Brain Res.* **102**, 467-470, compared with  
 1979a *Brain Res.* **102**, 471-474, compared with  
 1979b *Brain Res.* **102**, 475-478, compared with  
 1979c *Brain Res.* **102**, 479-482, compared with  
 1979d *Brain Res.* **102**, 483-486, compared with  
 1979e *Brain Res.* **102**, 487-490, compared with  
 1979f *Brain Res.* **102**, 491-494, compared with  
 1979g *Brain Res.* **102**, 495-498, compared with  
 1979h *Brain Res.* **102**, 499-502, compared with  
 1979i *Brain Res.* **102**, 503-506, compared with  
 1979j *Brain Res.* **102**, 507-510, compared with  
 1979k *Brain Res.* **102**, 511-514, compared with  
 1979l *Brain Res.* **102**, 515-518, compared with  
 1979m *Brain Res.* **102**, 519-522, compared with  
 1979n *Brain Res.* **102**, 523-526, compared with  
 1979o *Brain Res.* **102**, 527-530, compared with  
 1979p *Brain Res.* **102**, 531-534, compared with  
 1979q *Brain Res.* **102**, 535-538, compared with  
 1979r *Brain Res.* **102**, 539-542, compared with  
 1979s *Brain Res.* **102**, 543-546, compared with  
 1979t *Brain Res.* **102**, 547-550, compared with  
 1979u *Brain Res.* **102**, 551-554, compared with  
 1979v *Brain Res.* **102**, 555-558, compared with  
 1979w *Brain Res.* **102**, 559-562, compared with  
 1979x *Brain Res.* **102**, 563-566, compared with  
 1979y *Brain Res.* **102**, 567-570, compared with  
 1979z *Brain Res.* **102**, 571-574, compared with  
 1980a *Brain Res.* **102**, 575-578, compared with  
 1980b *Brain Res.* **102**, 579-582, compared with  
 1980c *Brain Res.* **102**, 583-586, compared with



## Towards Safer Penicillamine Prescribing

M. Mawhood

### ABSTRACT

Four factors for dose adjustment in rheumatological patients on the diaphane red/pink Penicillamine tablets are discussed. (1) To 1975 treatment was discontinued after side effects or at maximum tolerance for avoidance of side effects and withdrawal from treatment was dependent, and it appears for safety penicillamine prescribing is required.

### Introduction

Penicillamine (DL dimethyl cysteine) is a chelator of penicillins, and has been used in the treatment of rheumatoid disease in this country for about 8 years. Initial optimism was given by the observation of Jaffe (1942) that rheumatoid factor could be split by penicillamine. Penicillamine has been shown to be associated with gold in the treatment of rheumatoid disease (Huskinson *et al.* 1970) but its usefulness in the early 1970s was limited by a high withdrawal rate due to side effects, up to 30 per cent in the Multicentre Trial Group report (1973) due primarily to nausea, bone marrow depression and psychosis.

Further experience with the drug has shown that the incidence of side effects (with the possible exception of psychosis) can be reduced by the more gradual introduction of the drug at small well spaced increments, and the avoidance of the previous high maximum dose levels (Bey 1974; Day *et al.* 1974; Bell, 1974; Davis *et al.* 1975; Goldberg *et al.* 1975).

Development of a safer prescribing habit has been evolving for many years. In 1975 the British Medical Journal recommended increments of 125 mg penicillamine fortnightly to a total maintenance dose of

1,000-1,500 mg, while in 1977 the same journal recommended increments of 250 mg or less, increments of no less than 4 weeks, to a small daily maintenance dose of 500-750 mg. While (1976) recommended increments of 125 mg monthly to a total of 750 mg daily and more recently Jaffe (1977) reported suppression of rheumatoid disease activity in 4 of 5 patients treated for periods of up to one year with only 250 mg penicillamine daily without significant side effects in any of the 5 patients.

### Materials and Method

**Patient.** The 11 penicillamine-treated arthritic patients referred here all attended the Royal Naval Hospital, Plymouth. Nine have definite or classical rheumatoid disease as defined by the American Rheumatism Association, one of whom first presented with palindromic rheumatism. The other 2 patients comprise one with systemic sclerosis and one with mixed features of scleroderma and severe rheumatoid disease.

**Dosing Policy.** In 1975 increments of 250 mg penicillamine were made at intervals of 2 weeks or more, to a maintenance level of up to 1,500 mg. By 1977 increments of 125 mg were made monthly with an assumed ceiling of 750 mg daily maintenance dose which was exceeded in the case of our non-responder (Case 5).

**Pharmacology.** Full blood counts including platelet counts were performed at half monthly in all cases.

Urine and sputum for protein and blood were performed. Procedures of any degree, detected by dip stick testing, was followed by quantitative estimation of proteinuria on a 24-hour urine sample.

Response to Treatment was judged mainly by the patient's account of changes in symptoms and functional capacity, and by changes in morning stiffness and in subjective consumption. Response to treatment was ruled "insufficient" when pain and stiffness were abolished, no anti-inflammatory analgesics were required and functional capacity improved, good if all the latter features were achieved but anti-inflammatory analgesics were required, fair if only incomplete abolition of pain and stiffness were achieved despite additional anti-inflammatory agents but some improvement in functional capacity occurred and not when no subjective or objective change occurred.

**Side effects.** Proteinuria of 500 mg or more per 24 hours, thrombocytopenia of less than 150,000/platelets indicated as proteinuric dosage and late studies were regarded as indication for withdrawal of the drug. The following side effects were regarded as indications for the complete withdrawal of the drug.

- (a) Proteinuria of 500 mg or more per day
- (b) Platelet count  $< 120 \times 10^9/L$
- (c) Total white cell count  $< 4.0 \times 10^9/L$
- (d) Monocyte count  $< 2.0 \times 10^9/L$
- (e) Late rashes

Potential  
despite reduction  
in daily dosage

### Discussion

The safe prescription of penicillamine demands:

- (a) careful monitoring in dosage and in medical consequences
- (b) vigilance for side effects
- (c) a safe pre-planned response by the physician when side effects occur

Cases 1, 3 and 9 continue treatment with penicillamine and further monitoring in dosage may be necessary.

Excluding the 2 cases with systematic ulcers and sideroblastic anemia (cases 6 and 9) it can be seen that in the remaining 9 rheumatoid patients treatment was discontinued in 3 because of proteinuria, in one because of thrombocytopenia, in one because of rash, and in one because of lack of response.

Of the 4 rheumatoid patients whose dosage increments were restricted to 125 mg at intervals of four weeks (cases 1, 5, 7, 8) 3 are still taking the drug without side effects, one has discontinued the drug due to lack of effect but without side effect, and one has discontinued the drug due to proteinuria and skin rash. In contrast of the 5 patients whose penicillamine dosage was increased at a faster rate or to a higher final maintenance dose, 4 had side effects requiring withdrawal of the drug (but had obtained good or excellent effect from the drug) and one had neither benefit nor side effect from the drug. Although these numbers are too small for valid statistical conclusions to be drawn, they do accord with the dose-related side effects reported in larger series.

These factors are now discussed in more detail, and it is hoped that the dosing and monitoring factors outlined here will be of some value since a general physician and general duties medical officers concerned with the management of rheumatoid disease in district patients.



(c) *Preventing Relapse* As noted in the introduction, the incidence of side effects sufficiently serious to warrant withdrawal of prednisone therapy has been shown in several cases to be reducible by the adoption of more cautious initiation and maintenance dosages. At present most hematologists have probably adopted a preventing policy similar to that of White (1976) but obviously further research will be stimulated by Lally's pilot study (1977) in which he found the drug effective and safe at a total daily dose of 200 mg. It is not surprising to note that in that study Lally found that the overall beneficial response in the 4 patients was delayed for 10 to 24 weeks after introduction of the drug, whereas with larger doses a latent period of 12 to 14 weeks is more common. Gelling et al (1977) reports that some thrombocytopenia respond to as little as 125 mg prednisone daily. It is obvious therefore that an average minimum effective dose of prednisone has not yet been established and it is likely that in the next few years further more dose trials will establish whether efficacy is maintained and side effects further reduced by ultra low dose therapy.

(d) *Side effects and their management* Side effects occurring within the first 4 weeks of prednisone therapy are often unrelated to tumor and usually disappear on temporary reduction or withdrawal of the drug. Low cumulative side-effects can be given concerning the management of low risk side effects already present, namely, nausea or diarrhea and appearing after at least 3 months treatment for they may take several months to disappear; others require local or systemic steroid treatment and are more likely to occur on attempted re-introduction of the drug. For the management of subsequent prednisone prescribers low risk side effects may reasonably be regarded as indications for complete and permanent withdrawal of prednisone.

Loss of taste was a fairly common side

effect in earlier studies using high dose prednisone treatment and was sometimes sufficiently distressing to warrant discontinuation of treatment. With the present lower dosage regimen the side effect is less common and usually disappears spontaneously despite continuing therapy.

Monthly full blood counts are performed in order to monitor any decreased trend in white cell or platelet count so that by timely reduction or withdrawal of prednisone dosage further dangerous deterioration in cell counts is avoided. Despite the universal adoption of monthly blood counts during treatment isolated case reports of leukemia due to aplastic anaemia continue to appear (Bassford et al 1976; Richards et al 1976) and at present no absolute guidelines can be given on whether it is more prudent to reduce dosage or discontinue the drug completely when faced with evidence of marrow suppression. Hematologists with greater experience of the drug have found that at least in the case of thrombocytopenia (which is a more common hematological side effect than neutropenia) reduction of the dose of prednisone is usually sufficient to restore the platelet count.

Proteinuria is usually the only sign of a prednisone induced immune complex nephritis and may sometimes be sufficiently severe for a nephritic syndrome to develop. Bacon et al (1976) demonstrated proteinuria electron microscopic and immunofluorescent changes consistent with immune complex glomerulopathy for up to one year in patients with persistent prednisolone-induced proteinuria and suggested that the use of prednisone in rheumatoid diseases may induce permanent renal damage. Only long term follow up of renal function in such patients can relate Bacon's suggestion and until such evidence is produced it would appear prudent to withdraw the drug completely whenever more than a trace of

proteins is found on 2 or more monthly analyses.

### Conclusions

Maximum benefit to the arthralgic rheumatoid patient is obtained when the drug is introduced in small doses increased gradually and by small increments to a maximal maintenance dose, seraphron monitoring for side effects is maintained throughout the treatment period and the drug promptly withdrawn when serious side effects occur. To the rheumatoid under penicillamine offers a possibility of better control of his disease but because of the mandatory monthly blood and urine tests the man, however well, cannot be judged fit for duty at sea and is likely to be avoided from the service. For this reason penicillamine has little or no place in the early treatment of the rheumatoid sailor whose career will be protracted and disease possibly adequately suppressed by the prescription of drugs such as salicylates or chloroquin.

### Recommendations

1. Penicillamine (or salicylates, chloroquin, gold, methotrexate, cyclo phosphamide) is indicated for the treatment of active rheumatoid disease inadequately controlled by a variety of non-inflammatory agents.

2. Monitor WBC, platelet count and uricolytic for blood and protein to be confirmed before beginning treatment with penicillamine.

3. Initial dose of penicillamine to be 50 mg daily for one month.

4. In the second month daily dose to be 125 mg.

5. In the third and subsequent months daily dose to be increased by 125 mg at intervals of 4 weeks to a total daily dose of 500 mg attained in the fifth month.

6. Increase in dosage above 500 mg may be made exceptionally in the sixth month if the patient has not benefited from treatment but no side effects and particularly if he has been previously

Table 1

Case no.	Sex	Age	Specimen no.	WBC (x10 <sup>9</sup> /L)	Platelets (x10 <sup>9</sup> /L)	Urea (mmol/L)	Cr. (mmol/L)	Uric acid (mmol/L)	Protein (g/L)	Comments
1	M	32	10	10.5	250	3.0	0.1	0.1	0.1	
2	M	45	14	—	250	3.0	0.1	0.1	0.1	
3	F	44	16	—	250	3.0	0.1	0.1	0.1	
4	F	3	18	—	250	3.0	0.1	0.1	0.1	
5	M	35	20	—	250	3.0	0.1	0.1	0.1	
6	M	47	22	—	250	3.0	0.1	0.1	0.1	
7	M	4	24	—	250	3.0	0.1	0.1	0.1	
8	M	3	26	—	250	3.0	0.1	0.1	0.1	
9	M	3	28	—	250	3.0	0.1	0.1	0.1	
10	M	3	30	—	250	3.0	0.1	0.1	0.1	
11	M	3	32	—	250	3.0	0.1	0.1	0.1	
12	M	3	34	—	250	3.0	0.1	0.1	0.1	
13	M	3	36	—	250	3.0	0.1	0.1	0.1	
14	M	3	38	—	250	3.0	0.1	0.1	0.1	
15	M	3	40	—	250	3.0	0.1	0.1	0.1	
16	M	3	42	—	250	3.0	0.1	0.1	0.1	
17	M	3	44	—	250	3.0	0.1	0.1	0.1	
18	M	3	46	—	250	3.0	0.1	0.1	0.1	
19	M	3	48	—	250	3.0	0.1	0.1	0.1	
20	M	3	50	—	250	3.0	0.1	0.1	0.1	
21	M	3	52	—	250	3.0	0.1	0.1	0.1	
22	M	3	54	—	250	3.0	0.1	0.1	0.1	
23	M	3	56	—	250	3.0	0.1	0.1	0.1	
24	M	3	58	—	250	3.0	0.1	0.1	0.1	
25	M	3	60	—	250	3.0	0.1	0.1	0.1	
26	M	3	62	—	250	3.0	0.1	0.1	0.1	
27	M	3	64	—	250	3.0	0.1	0.1	0.1	
28	M	3	66	—	250	3.0	0.1	0.1	0.1	
29	M	3	68	—	250	3.0	0.1	0.1	0.1	
30	M	3	70	—	250	3.0	0.1	0.1	0.1	
31	M	3	72	—	250	3.0	0.1	0.1	0.1	
32	M	3	74	—	250	3.0	0.1	0.1	0.1	
33	M	3	76	—	250	3.0	0.1	0.1	0.1	
34	M	3	78	—	250	3.0	0.1	0.1	0.1	
35	M	3	80	—	250	3.0	0.1	0.1	0.1	
36	M	3	82	—	250	3.0	0.1	0.1	0.1	
37	M	3	84	—	250	3.0	0.1	0.1	0.1	
38	M	3	86	—	250	3.0	0.1	0.1	0.1	
39	M	3	88	—	250	3.0	0.1	0.1	0.1	
40	M	3	90	—	250	3.0	0.1	0.1	0.1	
41	M	3	92	—	250	3.0	0.1	0.1	0.1	
42	M	3	94	—	250	3.0	0.1	0.1	0.1	
43	M	3	96	—	250	3.0	0.1	0.1	0.1	
44	M	3	98	—	250	3.0	0.1	0.1	0.1	
45	M	3	100	—	250	3.0	0.1	0.1	0.1	
46	M	3	102	—	250	3.0	0.1	0.1	0.1	
47	M	3	104	—	250	3.0	0.1	0.1	0.1	
48	M	3	106	—	250	3.0	0.1	0.1	0.1	
49	M	3	108	—	250	3.0	0.1	0.1	0.1	
50	M	3	110	—	250	3.0	0.1	0.1	0.1	
51	M	3	112	—	250	3.0	0.1	0.1	0.1	
52	M	3	114	—	250	3.0	0.1	0.1	0.1	
53	M	3	116	—	250	3.0	0.1	0.1	0.1	
54	M	3	118	—	250	3.0	0.1	0.1	0.1	
55	M	3	120	—	250	3.0	0.1	0.1	0.1	
56	M	3	122	—	250	3.0	0.1	0.1	0.1	
57	M	3	124	—	250	3.0	0.1	0.1	0.1	
58	M	3	126	—	250	3.0	0.1	0.1	0.1	
59	M	3	128	—	250	3.0	0.1	0.1	0.1	
60	M	3	130	—	250	3.0	0.1	0.1	0.1	
61	M	3	132	—	250	3.0	0.1	0.1	0.1	
62	M	3	134	—	250	3.0	0.1	0.1	0.1	
63	M	3	136	—	250	3.0	0.1	0.1	0.1	
64	M	3	138	—	250	3.0	0.1	0.1	0.1	
65	M	3	140	—	250	3.0	0.1	0.1	0.1	
66	M	3	142	—	250	3.0	0.1	0.1	0.1	
67	M	3	144	—	250	3.0	0.1	0.1	0.1	
68	M	3	146	—	250	3.0	0.1	0.1	0.1	
69	M	3	148	—	250	3.0	0.1	0.1	0.1	
70	M	3	150	—	250	3.0	0.1	0.1	0.1	
71	M	3	152	—	250	3.0	0.1	0.1	0.1	
72	M	3	154	—	250	3.0	0.1	0.1	0.1	
73	M	3	156	—	250	3.0	0.1	0.1	0.1	
74	M	3	158	—	250	3.0	0.1	0.1	0.1	
75	M	3	160	—	250	3.0	0.1	0.1	0.1	
76	M	3	162	—	250	3.0	0.1	0.1	0.1	
77	M	3	164	—	250	3.0	0.1	0.1	0.1	
78	M	3	166	—	250	3.0	0.1	0.1	0.1	
79	M	3	168	—	250	3.0	0.1	0.1	0.1	
80	M	3	170	—	250	3.0	0.1	0.1	0.1	
81	M	3	172	—	250	3.0	0.1	0.1	0.1	
82	M	3	174	—	250	3.0	0.1	0.1	0.1	
83	M	3	176	—	250	3.0	0.1	0.1	0.1	
84	M	3	178	—	250	3.0	0.1	0.1	0.1	
85	M	3	180	—	250	3.0	0.1	0.1	0.1	
86	M	3	182	—	250	3.0	0.1	0.1	0.1	
87	M	3	184	—	250	3.0	0.1	0.1	0.1	
88	M	3	186	—	250	3.0	0.1	0.1	0.1	
89	M	3	188	—	250	3.0	0.1	0.1	0.1	
90	M	3	190	—	250	3.0	0.1	0.1	0.1	
91	M	3	192	—	250	3.0	0.1	0.1	0.1	
92	M	3	194	—	250	3.0	0.1	0.1	0.1	
93	M	3	196	—	250	3.0	0.1	0.1	0.1	
94	M	3	198	—	250	3.0	0.1	0.1	0.1	
95	M	3	200	—	250	3.0	0.1	0.1	0.1	
96	M	3	202	—	250	3.0	0.1	0.1	0.1	
97	M	3	204	—	250	3.0	0.1	0.1	0.1	
98	M	3	206	—	250	3.0	0.1	0.1	0.1	
99	M	3	208	—	250	3.0	0.1	0.1	0.1	
100	M	3	210	—	250	3.0	0.1	0.1	0.1	

Urea, mmol/L; Cr., mmol/L; Uric acid, mmol/L; Protein, g/L.



## A Useful Instrument Table when Operating at Sea and for Small Operating Theatres Aboard.

C. Chapman

Those who have had the task of performing major surgery at sea are familiar with the problems. For the benefit of those who may, at some time, have this experience to come they are:

1. Limited floor space.
2. An unstable floor.
3. Lack of an adequate number of skilled assistants.

For some time we have investigated various ideas to overcome these problems. Finally I settled on the instrument table described in this paper (Fig. 2).



Fig. 2. Table in place.

Lack of floor space is a characteristic of all workshops so that a table which almost completely overlaps the operating table has the advantage of

occupying minimum floor space. A large table can thus be made available in our main space (depending on instrument table from the deck) and was considered but rejected because in rough conditions it could swing in an alarming way possibly resulting in injury to the staff as well as the patient.

Trolleys of all types, of course, are out. They are too unstable and even if fitted with shockers to keep one or more wheels still will wobble across the deck. In addition, I have not yet seen a trolley with an adequate rise to its top. A Mayo type table has wire-cable features — it has a small rise and occupies little floor space — but it is too small to hold the instruments for a major procedure and is not suitable unless the wheels are removed and a heavy weight is placed across its bottom bar. In rough conditions these heavy lumps of metal seem to find their way on to the surgeon's foot.

We eventually had the table shown in the figure constructed in the ship's workshops. It can be dismantled into three parts for easy storage (Fig. 2). The top measures 26 inches across, is 24 inches wide (24 in.  $\pm$  allowed) and has a rim 2 inches (2 in.  $\pm$ ) broad high. The bottom of the table is all inclusive. The table top fits on to four telescopic metal table legs. The height of the table is adjusted by these legs which are fitted with locking pins. Finally the legs themselves are attached to rubber foot plates which have a cushion effect on the theatre floor.



Fig. 2. Disassembled table showing rubber camera foot and telescopic leg.

A special studio cloth is stretched to the table by tapes (Fig. 2). Before this head is covered by several drapes. Figs. 4 and 5 show the table in use.



Fig. 3. Single water drape in position.



Figs. 4 and 5. Table in use.

The only thing to remember is to set the height of the instrument table correctly before it is covered with studio drapes. In adjusting the height of all four legs to a later stage was for somewhat troublesome. Otherwise we have found the table to be entirely satisfactory.

#### *Acknowledgment*

I wish to thank the Shipwrights and Artisans of HMS Art Royal who constructed this very useful table for us.

## A New Mobile Dental Clinic

A. A. Darter

### Introduction

A new Mobile Dental Clinic will have gone into service with the Royal Navy hopefully by the time this is published (Fig. 1). As this may be the first of a new generation of dental clinics and as to some extent experimental nature of this period might like to know how its design was arrived at and why this sort of clinic was considered necessary.

Fig. 1



The Need — The Problems of Treatment for Small Ships

The actions of dental disease in young men presents a particular problem at ships not carrying dental officers because the lack of access to a dentist may last weeks or months during deployment. As we all know dental disease, principally dental caries and periodontal disease, can frequently be very painful and occasionally cause temporary disability. Dental clinics on small ships

personnel may, at worst have, often, consequences and at least be very inconvenient. For this reason the standard monthly 'bring up' clinics has to be operated for submarines.

In spite of provisions for treatment before 'bringing down' and the availability of small dental clinics adjacent to or on drydocks for voluntary treatment, it is necessary to keep one organized inspection and treatment of ships in the period before work up and deployment to some stations where this was not fully achieved, hence built for treatment on foreign ports have been required.

However even they are to have a 15 ship company. Commanding Officers do not welcome the absence of their men for dental treatment during the busy periods of preparation before work up, and deployment. Although dental checks can be made on board the travelling time in and from the clinic adjacent to a large dockyard can amount to one hour, quadrupling the time required for a 20 man unit. More time is lost through waiting time which is inevitable in a large clinic and through broken appointments. It often happens that a day may cannot be spared for 14 hours or more frequently, the conscientious worker considers the job is lost to have higher priority than his own dental health.

### Portable Dental Surgery

The ideal way of tackling this problem is

by dental officers taking a portable dental supply on board and working full time for a period of several weeks during a passage or work up. This is by no means always possible and the use of mobile dental clinics in dockyards is the alternative.

#### Dental Casework

The conventional caravan-type clinic has long been in regular use in dockyards but has the disadvantages of being confined to a very few specially prepared sites free of crane tracks and provided with mains supply and drainage points. These sites can still be some distance from ships being serviced and it is not possible to move the clinic on a day to day basis.

#### The Advantages of Mobility

With a clinic placed alongside a ship there is no travelling or waiting time and work can be spaced more easily or fitted in between appointment quickly exchanged within the ship. Documents are more easily to hand. The visual and direct verbal contact between ship and clinic that day to day mobile dental clinic facilities, a constant flow of patients. The ability to visit a clinic between several small ships preserves the exclusive contact yet enables time spaced work such as prosthodontics and root treatment to be carried out.

#### The Solution

In order to achieve this greater mobility a prime mover clinic is required which will be capable of operating either from mains supply when available or independently. It would need to be of a rugged character capable of going wherever other standard service vehicles might be sent.

#### Design

At the end of 1976 a new Bedford T100 van was allocated for conversion to a Dental Clinic and I was given the task of

writing its specification and designing the layout. After careful measurement of the base shell and discussion with the coach builders about the strength of floor, sides and roof for attachment of equipment, the design work was started.

Sketches and suggestions from a number of dental officers who had worked at dental clinics were considered and, after deciding the general layout, the ergonomics of the limited dentistry was looked at. Many measurements were made to determine ideal dimensions and heights of work tops, cupboards etc. (Fig. 1). Before then covered the resulting sketches and scale drawings which were used after dental advice and modification in the form of the working drawings (Fig. 2).



#### Problems of Design

It was evident from the start that some compromise would have to be made regarding the independence and mobility of the clinic. The use of water and waste tanks which could be carried within the vehicle would without causing limit its use to a period of 2-3 days. Another problem was generator size, since the largest that could be carried without the use of a trailer was of 2.0kW. With this restriction half the power required to operate all the equipment at the same time. However, most of the electrical equipment requires power only intermittently and with the use of pre-stored measurements for the short periods envisaged in deployment, the greatest use of power, the unitary, could be switched off or reduced at the end of sessions.

This constraint will render the dental office in some degree when operating on the premises. Fortunately the manual items such as compressor, operating light, aspirator and ventilation fans may be used therapeutically and the X-ray apparatus and other instruments use of power will still be available. A complicated switching arrangement to allow the use of limited equipment was discarded in favor of the use of the operator's disconnect plus an automatic reset to give the permitted power limit was considered.

#### Conclusion

The design out of the house shall now proceed and hopefully by the month builders at the RM Marine Transport Depot, Stanthorpe Occasional visits during construction were made by myself and CP0044, Baynes to check progress. Mr R. Davis RCM Dental Stores Officer at RMHS, Rother, also visited to advise on the type and types of materials required for items of fixed equipment.

#### Surgery Layout (fig 3)

The surgery is designed for four-handed dentistry by seated operators but allows some flexibility in operating position. The chair although locked down has alternative knee positions and can be rotated. The dental unit is the Grimes type which is fully mobile within the range of its air and water lines and the Veridom aspirator is also freely mobile.



The work surface round the operating area is at a distance from the patient's head which will allow movement of the dentist and maintain on their team yet will allow them to reach instruments and prepare materials without moving. The area below the work surface is free of cupboards and drawers to allow greater freedom of movement on operating unit. Several small pull out extensions of the work surface are available if required. The height of the work surface at  $30'$  might be considered slightly higher than ideal but this is to allow the operator or dental unit to be placed under it if desired. A hand wash bowl is within reach of both operators and cupboards are placed over the work surface on either side of the surgery at a height suitable from the seated position.

The provision of a water flatted spittoon would have created a problem of wear and waste tank size and also restricted the flexibility of working positions. Therefore a suction dental type spittoon on the aspirator is provided. The working area is forward of the operating area on the outside of the chair and has no worktop and double sink at  $36'$  height. An overcoat bar is placed over the entrance.

Operator knee area the worktop is hinged for prosthodontic work and has a plaster hole with a hinged removable waste bag underneath. There are ample cupboards and drawers on both sides of the chair.

#### Office and Waiting Room

The patients entrance on the outside leads to a small separately heated waiting room and the office staff changing room is opposite. Whether or not the outside stairs to the floor entrance on the office are used will depend on use and duration of stay.

#### Heating/cooling

Air conditioning equipment provides heating or cooling using material air and with the extractor fan should give adequate



ventilation. A small fan heater is available in the waiting room.

The sides and roof are lined with plastic laminate and are well insulated. The floor has a flexible wood layer with a non-porous vinyl covering which extends on to the sides for ease of cleaning and to prevent leakage of spill mercury. Work tops are also sealed against the ingress of mercury.

Noise levels should be low due to the degree of insulation. The compressor is notably quiet and is contained in an externally ventilated sound insulated cupboard. Generator noise and vibration will be minimised by its capability to be

lowered to the ground on casters when in use.

#### Future Needs

At the time of writing, the client was found new and untried. No doubt some problems will be encountered in its use which will result in modifications to the design of future versions. The breaking of more precise master classes will also depend on how useful its greater mobility and independence proves to be in bringing higher standards of dental service to the Fleet.

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## BOOK REVIEW

**CONTEMPORARY ARTISTS** by Stephen Jacks and Michael Wadley. Pp. 146. Bristol: Bristol Journal, 1980.

This book is a guide to a world of art and artists (without, unfortunately, names) and it is a pity that the volume does not go with a listing of the names that it gives but the purpose of it is to bring attention to the names of the artists and to the ideas that they have in their minds. It is a pity that the book does not go with a listing of the names that it gives but the purpose of it is to bring attention to the names of the artists and to the ideas that they have in their minds.

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## Dunkirk 1940 — An Eye-Witness Account

James Dine

In May, 1940, the Third Minesweeping Flotilla as general, and HMS Gloucester in particular, were having a very pleasant war. The weather was beautiful and based on North Shields, our task was to search an area outside the mouth of the River Tyne for mines and if any were found to clear the area. There could be done only two hours either side of high water. The operational area was only half an hour's steaming from North Shields.

The ships when in harbour were berthed alongside shore lines was pleasant the natives were friendly and as there is needed had suggested lady friends, this was a mistake a paradise. But the tide says its ending in all good things there may be! On May 25 a signal was received from Admiralty Home station with all dispatch. Proceed to Harwich. Do not wait for libertymen who will neglect Harwich.

At Harwich the flotilla was berthed unattended, provisioned and libertymen reported. No shore leave was given and customs searched all the ship boats into a harbour. Orders were to proceed to the Godwin Lightship which was sighted pm May 26 and orders were to proceed to Dunkirk. Fuelment prevailed and on the bridge everyone was on the lookout for a buoy at which a 90° port alteration of course should be made. Suddenly the dip was dominated by numerous searchlights, blue in colour and movement of boats that we were surrounded in evening. Covered a rapid check of the course was made. The size of the searchlights was put pointed at

Gravelines and it was assumed that the buoy for which we sought had been engaged by the Germans.

Just before dawn on May 27 the ship arrived off La Panne where a misty assessment of craft had preceded her. A Thetis near had followed fully in the night, unattended. There were destroyers, minesweepers and suppling the Midgets: active gaudier.

The beach was crowded with soldiers who appeared to be in remarkably good order. Some spaces stretched into the water.

We lowered two whalers and the motorboat which set off towing the whalers. The boats did not remain in company for long and then the whalers had to be propelled by oars. The retreating soldiers then began to cover ashore and it was not long before it became generally known that HMS Gloucester carried a medical officer and then the weather began to appear. There were walking wounded and did not present a great problem. The Sixth North Atlantic had volunteered to man an air in a whaler and his absence slowed the movements of the wounded.

The tide water outside was walking sand and shingle which caused problems for the engineering staff. Then the Stokes around Gloucester were at night stations and the Le Havre, greeted by many searchlights and close range weapons of some nighty warships, perhaps evolved that they were unobscured and chose a most vulnerable target which was unable to provide

oppression: the soldiers on the beach. Rifle and Bren gun fire could be seen from the soldiers who were lying motionless, propped.

At last the ship was full to capacity. The ladder and the anchor were raised and control set for Dover. The *Spokes* made a final pass which was a little half-hearted particularly as two lighters had appeared on the scene and driven off the *Spokes* who had been machine gunning the beach.

The wounded were recovered and some notes made about them but on the passage back the main problem was food. All aboard had discovered they were hungry and thirsty. The ship's company had no more for a day: many soldiers had not eaten for a week. The galleys were just as threatened with soldiers as the rest of the ship. However, there was plenty of reflections and stacks of sorted food, marmalade and gallons of cream, were produced which was very welcome.

In Dover new problems were encountered: the attempt was made to replenish the stores and tea, apart from food and ammunition there was an increasing reluctance to part with anything. Food? Marmalade? Medical stores? There were no! However, after numerous telephone calls and signals our requirements were met, at least in part, and preparations were made to sail departing on May 26 under the impression that adequate preparations had been made for what lay in store. The trouble was that the Germans, particularly the Luftwaffe, were also becoming fast. The portsmen were closing the beach, which was still crowded, and the *Spokes* were more numerous. They were not attacking the men on the beach nor the ships at a distance. Their chosen targets were the ships full with military personnel awaiting for launch. The visiting *Spokes* were out of range of the 4 guns, so it was impossible to give support and there were many casualties. The wounded included a few officers who had been brought in by their men and there were terrible casualties

amongst them, notably damaged wounds and burns. A bullet through a soldier's foot had reduced it to the consequence of porridge. A sun medical party was organised to circulate in front of the beach to run the passable course and all half broken boats. Wounds had to be covered with dressings and treatment suggested location of firing glass everywhere. However, the gun crew started two *Spokes* that dawn.

Dover was reached again, ammunition had and stores were taken aboard and orders were received to occupy the approaches to and from Dunkirk made as it was thought that they had been mined. All day on May 26 the channels were swept, the *Spokes* attacked and the guns fired. A stricken V & W class destroyer was seen. Personnel who had time to do so slept, in spite of the noise, and at dusk once more the task of looking soldiers was approached. Boats were now scarce because ships had left their bases to continue the work while they piled back to UK and many soldiers had attempted to return home in motorboats with insufficient fuel or no whistles by sea or land. Ships picked up those sighted but who knew how many were lost. Disputes before dawn arose on from the *Spokes* treatment. This time we unloaded in Sheerness and a few volunteer replacement engineers' attempts came aboard. On May 31 in the early evening, *Gloucester* sailed again and off Ramsgate a small sailing yacht was taken in tow. Its crew of two had been trying to get to Dunkirk for a week without success. A signal was received authorising all ships in Operation *Benbow* to proceed as full speed until the operation ended. A signal was circulated by the Captain. This is the *Gloucester* story of June: May the deeds of the Royal Navy outgiving their lives with those on that occasion "it was just after dawn on a lovely day. Admiral Ramsey arrived in an MTR to analyse the situation.

A signal was received. Any tanks seen are German. Dead on our beach tanks appeared

over the sand dunes, taking their legs at the front the BEP offered, but they returned without HMS Gloucester. Both guns were burning and were damaged. Another fire was opened on the formation and it appeared that they were hit. When the smoke and dust settled they were gone and did not reappear. Then the Luffwaffe arrived. By this time the gun crews had a real appetite for their work. While the ship was at anchor it was not seriously damaged but when full and attacking the boats it appeared that the Luffwaffe regarded HMS Gloucester as *Pöbel*, Enemy Number One. She turned and moved over the sandbanks. Four ships were sunk by direct hits in twenty minutes. *MSF Skagge* & *MS Skud* destroyed, a French minesweeper and one undamaged. The (empty) dingy things of the 4' the side of the first Lewis, then the first barbed, 8'5" produced three distinctive sounds, punctuated by the ding along the hull of the next mine. The 4' gun ran out of ammunition and continued in the sub-caliber and smoke shells as anything not being because a special target. One mine was then down. The 8'5" then the out after for all three, which meant quite a cheer. As long as the range of the Italian could no longer reach the ship. Comparison price regard and the work of feeding the tired and hungry troops and standing in the rowed could proceed.

However, again the most battle for more, without which little help could be given, and away once more with instructions to go alongside the mine. Now French troops began to appear amongst the retreating army. The Welsh Guards gave a display of discipline by forming single rank and marching as they came aboard. The French were unwilling to go below and the Sub-Lieutenant was told to say: A line in

and point down the ladder. This worked very well. At dawn the ship sailed and the Italian were waiting. The Welsh Guards posted themselves all round the ship with Bren guns and rifles. Then from the Italian did not pass their attack home with quite the same determination. When a gun opened fire a quarrelsome between the docks asked: "What's that?" in some alarm. When told it was the ship's most armament he said: "Do you hear that boys? We have our own attack!" That seemed to settle morale.

Two more signals. Unless we don't is given. Operation *Gyrfalcon* cannot continue! Stop! Air cover will be given from dawn to dusk. During the hours of darkness enemy airfields will be bombed at hourly intervals.

Two more trips were made by HMS Gloucester and there was very little incident. We were the second last ship out. A signal was received. Proceed with all dispatch. The Germans are four hundred yards from the mole. The gun crews were ready to welcome them. The ship outside Gloucester decided to turn instead of going out across and grounded herself. However, she was refloated easily enough.

In November, an HMSA found a wreck in an engine bed place. Hydrographed all four and found that all were cracked from end to end by the mine mines. Orders were received to proceed to Grande Parvée where the ship arrived during the night.

Four thousand troops had been brought home. One hundred wounded of whom 100 were seriously injured. Men had been seen diving themselves in the lake and beyond. It was an experience I had as a Sergeant Lieutenant and never easily forgotten.

*Despite the agreement of Frederick Ashurst as the creation of the MEDG it should not be forgotten: — Ed*

## Exercise Tolerance in Nuclear Submariners

W. M. Edmondson

### ABSTRACT

*Exercise tolerance was assessed in 133 crew members of a nuclear submarine in the beginning and at the end of a 6-week period. Before the assignment related to working this nuclear war ship physical fitness declined in 60 men. During the 6-week period of the voyage, however, a mean 28.1 per cent decrease in exercise tolerance*

### Introduction

The effect of age, physique and smoking on physical fitness have been extensively investigated. The effects of hypoxemia have been studied under laboratory conditions (Davies Smith, Louch, Moore & Gray 1976; Nussler, Clark & Welch 1970). In this investigation, exercise tolerance was measured at the onset of a nuclear submarine at the beginning and at the end of a 6-week period. In addition to the elevated ambient carbon dioxide level and the restriction of physical activity on board a submarine, the effects of age, physique and smoking habits on physical fitness were studied. These factors were assessed both independently and in combination with each other.

### Procedure

There were 133 subjects in the investigation. Their ages ranged from 18 to 49 (mean 26 years and 5 months). The median age was 27. None of these men took any exercise during the 6-week period. However, exercise tolerance was also measured in an additional 11 men who took regular exercise. Because of the size of this group and the consequent difficulty in obtaining statistically significant results, it

was not incorporated into the main study. The results are, however, presented for completeness.

The height and weight of each subject was recorded, and the reciprocal pedal index (RPI) determined according to the formula:

$$RPI = \text{height} \div (\text{weight})^{1/2}$$
 Height was measured in inches and weight in pounds (McGuinness and Sloan 1971).

The RPI is a measure of leanness; men with a high index tend to have an ectomorphic physique. Fifty subjects had RPI's of less than 12.5, and were all heavier build than the remainder.

The daily consumption of cigarettes by each man was recorded. Eighty-two men were classified as smokers under the Medical Research Council definition (MRC 1964).

The resting pulse rate (PR rest) was recorded, after which each subject exercised for one minute on a Monarch Bicycle Ergometer. A work rate of 125 Watts was achieved by pedalling at a constant 40 rpm at a flywheel resistance equivalent of 2 kiloponds. Immediately after the exercise was finished the pulse rate was counted over 15 seconds (PR max) and the pulse recovery time measured to onset. An exercise tolerance index (ETI) was calculated from the formula:

$$ETI = \frac{\text{PR max} - \text{PR rest}}{1000}$$

The ETI correlated with the level of fitness of the subject.

This index was derived from the fitness

Index used by Douglas, Crawford and Smith (1942) in the original Harvard Ship Test experiments. Subsequent work has confirmed its validity as a simple measure of physical fitness (Marrington 1954).

In order to measure the influence of circadian rhythm, meals and water-drinking on the subjects they were tested at equivalent times of day on each occasion. They were encouraged not to smoke within the hour before exercise testing.

Temperature and humidity in the submarine were kept constant. The partial pressure of carbon dioxide was maintained between 5.5 and 6.0 mmHg (mean 6.5 mmHg) while the oxygen tension fluctuated above 100 mmHg throughout the period.

## Results

The results are displayed in Tables 5-8.

Age and physique separately and in combination had no effect on FFI on Day 1 (Tables 1a, 1b and 1d). While the mean FFI of all subjects showed a 26.0 per cent decrease over the six week period, that for the older men fell by 29.1 per cent, and that for older men of lighter build (SCPI > 17.5) by 31.0 per cent.

Table 1b shows that smokers had a significantly lower mean FFI than non smokers on Day 1, but that both groups deteriorated at the same rate. When age is also taken into account, however, Table 1c it can be seen that there was no significant difference in fitness on Day 1 between the younger smokers and non smokers. The older 27 year old smokers became more unfit than their non smoking counterparts so that on Day 42 they showed a 37.7 per cent decrease in FFI

Table 1a  
The effects  
of age on  
FFI at  
days 1 and 42

Treatment	Age	No. of subjects	Percentage decrease in FFI				
			Mean	Standard Deviation	Standard Error	Difference of Means	Significance
Table 1a The effects of age on FFI at days 1 and 42	4-19	1	0.58	1.11	0.58	0.03	NS
	20-29	1	0.85	1.05	0.58		
	30-39	1	0.58	1.05	0.58		
	40-49	1	0.85	1.05	0.58	0.03	NS
	50-59	1	0.85	1.05	0.58		
	60-69	1	0.85	1.05	0.58		
Table 1b The effects of smoking on FFI at days 1 and 42	Smoker	1	0.58	1.11	0.58	0.03	P<0.05
	N	1	0.85	1.05	0.58		
	Smoker	1	0.58	1.11	0.58		
	N	1	0.85	1.05	0.58	0.03	P<0.05
	Smoker	1	0.58	1.11	0.58		
	N	1	0.85	1.05	0.58		
Table 1c The effects of age and smoking on FFI at days 1 and 42	4-19	1	0.58	1.11	0.58	0.03	NS
	20-29	1	0.85	1.05	0.58		
	30-39	1	0.58	1.11	0.58		
	40-49	1	0.85	1.05	0.58	0.03	NS
	50-59	1	0.85	1.05	0.58		
	60-69	1	0.85	1.05	0.58		
Table 1d The effects of physique on FFI at days 1 and 42	4-19	1	0.58	1.11	0.58	0.03	NS
	20-29	1	0.85	1.05	0.58		
	30-39	1	0.58	1.11	0.58		
	40-49	1	0.85	1.05	0.58	0.03	NS
	50-59	1	0.85	1.05	0.58		
	60-69	1	0.85	1.05	0.58		

compared with 28.8 per cent in the non-smokers.

Table 2 also shows that the older smokers had a significantly lower mean ETI on Day 1 than the older non-smokers. Although this difference was maintained on Day 42, the latter had decreased by 31.3 per cent compared with the 26.4 per cent decline of the smokers. This anomaly is explained below.

The effects of the combination of age and physique on ETI are illustrated in Table 3. On Day 1 there was no significant difference between the smokers and non-smokers of lighter build ( $BMI < 12.5$ ). However the smokers deteriorated by 32.9 per cent compared with 18.5 per cent in the non-smokers, a significant difference. Conversely smoking caused a significant reduction in ETI on Day 1 in the group of

more heavily built men ( $BMI > 12.5$ ). The non-smokers in this group, however, showed a more severe fall in ETI over six weeks (20.4%) than the smokers (16.4%). Despite this, on Day 42 the non-smokers were still significantly fitter than the smokers in the  $BMI < 12.5$  group. The marked deterioration in fitness in the non-smokers may appear paradoxical and the situation is similar to that seen in the over 27 year old non-smoking group (Table 2). The reason is that the non-smokers in the older age group, as in the  $BMI < 12.5$  group, had high mean ETI on Day 1 (4.77 and 4 litres respectively).

They were in fact the fittest groups in the study at the start of the investigation. The smokers in these categories (age > 27 or  $BMI > 12.5$ ) on the other hand were already relatively unfit on Day 1, and

Table 1  
The effect of age and smoking status on ETI on Day 1 and 42

Categorization of subjects		Age & sex distribution table						
AGE	SEX	Non-smokers	Smokers	Mean	Standard deviation	Mean	Standard deviation	ETI on Day 1
18-20	Male	1	12	1.57	1.28	1.57	1.28	2.0
21-25	Male	1	12	1.57	1.28	1.57	1.28	2.0
26-30	Male	1	12	1.57	1.28	1.57	1.28	2.0
31-35	Male	1	12	1.57	1.28	1.57	1.28	2.0
36-40	Male	1	12	1.57	1.28	1.57	1.28	2.0
41-45	Male	1	12	1.57	1.28	1.57	1.28	2.0
46-50	Male	1	12	1.57	1.28	1.57	1.28	2.0
51-55	Male	1	12	1.57	1.28	1.57	1.28	2.0
56-60	Male	1	12	1.57	1.28	1.57	1.28	2.0
61-65	Male	1	12	1.57	1.28	1.57	1.28	2.0
66-70	Male	1	12	1.57	1.28	1.57	1.28	2.0
71-75	Male	1	12	1.57	1.28	1.57	1.28	2.0
76-80	Male	1	12	1.57	1.28	1.57	1.28	2.0
81-85	Male	1	12	1.57	1.28	1.57	1.28	2.0
86-90	Male	1	12	1.57	1.28	1.57	1.28	2.0
91-95	Male	1	12	1.57	1.28	1.57	1.28	2.0
96-100	Male	1	12	1.57	1.28	1.57	1.28	2.0
101-105	Male	1	12	1.57	1.28	1.57	1.28	2.0
106-110	Male	1	12	1.57	1.28	1.57	1.28	2.0
111-115	Male	1	12	1.57	1.28	1.57	1.28	2.0
116-120	Male	1	12	1.57	1.28	1.57	1.28	2.0
121-125	Male	1	12	1.57	1.28	1.57	1.28	2.0
126-130	Male	1	12	1.57	1.28	1.57	1.28	2.0
131-135	Male	1	12	1.57	1.28	1.57	1.28	2.0
136-140	Male	1	12	1.57	1.28	1.57	1.28	2.0
141-145	Male	1	12	1.57	1.28	1.57	1.28	2.0
146-150	Male	1	12	1.57	1.28	1.57	1.28	2.0
151-155	Male	1	12	1.57	1.28	1.57	1.28	2.0
156-160	Male	1	12	1.57	1.28	1.57	1.28	2.0
161-165	Male	1	12	1.57	1.28	1.57	1.28	2.0
166-170	Male	1	12	1.57	1.28	1.57	1.28	2.0
171-175	Male	1	12	1.57	1.28	1.57	1.28	2.0
176-180	Male	1	12	1.57	1.28	1.57	1.28	2.0
181-185	Male	1	12	1.57	1.28	1.57	1.28	2.0
186-190	Male	1	12	1.57	1.28	1.57	1.28	2.0
191-195	Male	1	12	1.57	1.28	1.57	1.28	2.0
196-200	Male	1	12	1.57	1.28	1.57	1.28	2.0
201-205	Male	1	12	1.57	1.28	1.57	1.28	2.0
206-210	Male	1	12	1.57	1.28	1.57	1.28	2.0
211-215	Male	1	12	1.57	1.28	1.57	1.28	2.0
216-220	Male	1	12	1.57	1.28	1.57	1.28	2.0
221-225	Male	1	12	1.57	1.28	1.57	1.28	2.0
226-230	Male	1	12	1.57	1.28	1.57	1.28	2.0
231-235	Male	1	12	1.57	1.28	1.57	1.28	2.0
236-240	Male	1	12	1.57	1.28	1.57	1.28	2.0
241-245	Male	1	12	1.57	1.28	1.57	1.28	2.0
246-250	Male	1	12	1.57	1.28	1.57	1.28	2.0
251-255	Male	1	12	1.57	1.28	1.57	1.28	2.0
256-260	Male	1	12	1.57	1.28	1.57	1.28	2.0
261-265	Male	1	12	1.57	1.28	1.57	1.28	2.0
266-270	Male	1	12	1.57	1.28	1.57	1.28	2.0
271-275	Male	1	12	1.57	1.28	1.57	1.28	2.0
276-280	Male	1	12	1.57	1.28	1.57	1.28	2.0
281-285	Male	1	12	1.57	1.28	1.57	1.28	2.0
286-290	Male	1	12	1.57	1.28	1.57	1.28	2.0
291-295	Male	1	12	1.57	1.28	1.57	1.28	2.0
296-300	Male	1	12	1.57	1.28	1.57	1.28	2.0
301-305	Male	1	12	1.57	1.28	1.57	1.28	2.0
306-310	Male	1	12	1.57	1.28	1.57	1.28	2.0
311-315	Male	1	12	1.57	1.28	1.57	1.28	2.0
316-320	Male	1	12	1.57	1.28	1.57	1.28	2.0
321-325	Male	1	12	1.57	1.28	1.57	1.28	2.0
326-330	Male	1	12	1.57	1.28	1.57	1.28	2.0
331-335	Male	1	12	1.57	1.28	1.57	1.28	2.0
336-340	Male	1	12	1.57	1.28	1.57	1.28	2.0
341-345	Male	1	12	1.57	1.28	1.57	1.28	2.0
346-350	Male	1	12	1.57	1.28	1.57	1.28	2.0
351-355	Male	1	12	1.57	1.28	1.57	1.28	2.0
356-360	Male	1	12	1.57	1.28	1.57	1.28	2.0
361-365	Male	1	12	1.57	1.28	1.57	1.28	2.0
366-370	Male	1	12	1.57	1.28	1.57	1.28	2.0
371-375	Male	1	12	1.57	1.28	1.57	1.28	2.0
376-380	Male	1	12	1.57	1.28	1.57	1.28	2.0
381-385	Male	1	12	1.57	1.28	1.57	1.28	2.0
386-390	Male	1	12	1.57	1.28	1.57	1.28	2.0
391-395	Male	1	12	1.57	1.28	1.57	1.28	2.0
396-400	Male	1	12	1.57	1.28	1.57	1.28	2.0
401-405	Male	1	12	1.57	1.28	1.57	1.28	2.0
406-410	Male	1	12	1.57	1.28	1.57	1.28	2.0
411-415	Male	1	12	1.57	1.28	1.57	1.28	2.0
416-420	Male	1	12	1.57	1.28	1.57	1.28	2.0
421-425	Male	1	12	1.57	1.28	1.57	1.28	2.0
426-430	Male	1	12	1.57	1.28	1.57	1.28	2.0
431-435	Male	1	12	1.57	1.28	1.57	1.28	2.0
436-440	Male	1	12	1.57	1.28	1.57	1.28	2.0
441-445	Male	1	12	1.57	1.28	1.57	1.28	2.0
446-450	Male	1	12	1.57	1.28	1.57	1.28	2.0
451-455	Male	1	12	1.57	1.28	1.57	1.28	2.0
456-460	Male	1	12	1.57	1.28	1.57	1.28	2.0
461-465	Male	1	12	1.57	1.28	1.57	1.28	2.0
466-470	Male	1	12	1.57	1.28	1.57	1.28	2.0
471-475	Male	1	12	1.57	1.28	1.57	1.28	2.0
476-480	Male	1	12	1.57	1.28	1.57	1.28	2.0
481-485	Male	1	12	1.57	1.28	1.57	1.28	2.0
486-490	Male	1	12	1.57	1.28	1.57	1.28	2.0
491-495	Male	1	12	1.57	1.28	1.57	1.28	2.0
496-500	Male	1	12	1.57	1.28	1.57	1.28	2.0
501-505	Male	1	12	1.57	1.28	1.57	1.28	2.0
506-510	Male	1	12	1.57	1.28	1.57	1.28	2.0
511-515	Male	1	12	1.57	1.28	1.57	1.28	2.0
516-520	Male	1	12	1.57	1.28	1.57	1.28	2.0
521-525	Male	1	12	1.57	1.28	1.57	1.28	2.0
526-530	Male	1	12	1.57	1.28	1.57	1.28	2.0
531-535	Male	1	12	1.57	1.28	1.57	1.28	2.0
536-540	Male	1	12	1.57	1.28	1.57	1.28	2.0
541-545	Male	1	12	1.57	1.28	1.57	1.28	2.0
546-550	Male	1	12	1.57	1.28	1.57	1.28	2.0
551-555	Male	1	12	1.57	1.28	1.57	1.28	2.0
556-560	Male	1	12	1.57	1.28	1.57	1.28	2.0
561-565	Male	1	12	1.57	1.28	1.57	1.28	2.0
566-570	Male	1	12	1.57	1.28	1.57	1.28	2.0
571-575	Male	1	12	1.57	1.28	1.57	1.28	2.0
576-580	Male	1	12	1.57	1.28	1.57	1.28	2.0
581-585	Male	1	12	1.57	1.28	1.57	1.28	2.0
586-590	Male	1	12	1.57	1.28	1.57	1.28	2.0
591-595	Male	1	12	1.57	1.28	1.57	1.28	2.0
596-600	Male	1	12	1.57	1.28	1.57	1.28	2.0
601-605	Male	1	12	1.57	1.28	1.57	1.28	2.0
606-610	Male	1	12	1.57	1.28	1.57	1.28	2.0
611-615	Male	1	12	1.57	1.28	1.57	1.28	2.0
616-620	Male	1	12	1.57	1.28	1.57	1.28	2.0
621-625	Male	1	12	1.57	1.28	1.57	1.28	2.0
626-630	Male	1	12	1.57	1.28	1.57	1.28	2.0
631-635	Male	1	12	1.57	1.28	1.57	1.28	2.0
636-640	Male	1	12	1.57	1.28	1.57	1.28	2.0
641-645	Male	1	12	1.57	1.28	1.57	1.28	2.0
646-650	Male	1	12	1.57	1.28	1.57	1.28	2.0
651-655	Male	1	12	1.57	1.28	1.57	1.28	2.0
656-660	Male	1	12	1.57	1.28	1.57	1.28	2.0
661-665	Male	1	12	1.57	1.28	1.57	1.28	2.0
666-670	Male	1	12	1.57	1.28	1.57	1.28	2.0
671-675	Male	1	12	1.57	1.28	1.57	1.28	2.0
676-680	Male	1	12	1.57	1.28	1.57	1.28	2.0
681-685	Male	1	12	1.57	1.28	1.57	1.28	2.0
686-690	Male	1	12	1.57	1.28	1.57	1.28	2.0
691-695	Male	1	12	1.57	1.28	1.57	1.28	2.0
696-700	Male	1	12	1.57	1.28	1.57	1.28	2.0
701-705	Male	1	12	1.57	1.28	1.57	1.28	2.0
706-710	Male	1	12	1.57	1.28	1.57	1.28	2.0
711-715	Male	1	12	1.57	1.28	1.57	1.28	2.0
716-720	Male	1	12	1.57	1.28	1.57	1.28	2.0
721-725	Male	1	12	1.57	1.28	1.57	1.28	2.0
726-730	Male	1	12	1.57	1.28	1.57	1.28	2.0
731-735	Male	1	12	1.57	1.28	1.57	1.28	2.0
736-740	Male	1	12	1.57	1.28	1.57	1.28	2.0
741-745	Male	1	12	1.57	1.28	1.57	1.28	2.0
746-750	Male	1	12	1.57	1.28	1.57	1.28	2.0
751-755	Male	1	12	1.57	1.28	1.57	1.28	2.0
756-760	Male	1	12	1.57	1.28	1.57	1.28	2.0
761-765	Male	1	12	1.57	1.28	1.57	1.28	2.0
766-770	Male	1	12	1.57	1.28	1.57	1.28	2.0
771-775	Male	1	12	1.57	1.28	1.57	1.28	2.0
776-780	Male	1	12	1.57	1.28	1.57	1.28	2.0
781-785	Male	1	12	1.57	1.28	1.57	1.28	2.0
786-790	Male	1	12	1.57	1.28	1.57	1.28	2.0
791-795	Male	1	12	1.57	1.28	1.57	1.28	

thereby had less exercise tolerance in test.

Ten men (including 5 smokers) who took regular exercise improved their mean RFI from 4.13 to 5.25 over the 8 week period. This finding is not, however, statistically significant.

### Discussion

This study shows that of all the factors contributing to loss of aerobic tolerance in nuclear submariners smoking and prolonged periods are the most important. Age and physique particularly influence fitness in men who smoke. Most previous investigations studying the effects of age on fitness have shown little decline below the age of 30. Although Lange Andersen (1955) found a linear decrease in cardiovascular compliance between the ages of 20 and 40, Robinson (1938) found that aerobic capacity fell only gradually until the age of 40. Astrom (1956) also measured aerobic capacity. His subjects showed a marked deterioration between the ages of 25 and 35. But thereafter aerobic tolerance decreased only slowly with age. His studies, however, included female subjects.

The finding that RFI had no effect on exercise tolerance may seem surprising. The index is, however, a measure of buoyancy of physique and not of body composition. While extra weight due to adipose tissue should lower the RFI, extra weight due to muscle should not do so. Secondly the subject does not support his own weight when exercising on the bicycle ergometer. Stann (1968) compared fitness with anthropometric parameters such as height, weight, surface area, midupper arm/forearm index and total body fat proportion. In maintaining fitness using the Harvard Step Test in which the subject supports his own weight he found a significant negative correlation between and both fat proportion. He also found a positive

correlation between fitness and RFI. However, when exercise was performed on a bicycle ergometer, he found that no such correlation occurred unless the load was proportional to the subject's weight. When the work was the same in each subject, as it was in the present study, no correlation existed, and clearly was no disadvantage.

In a further study using the Harvard Step Test, McClelland and Mann (1977) found a significant correlation between fitness and RFI. Early work, again using the Step Test, suggested no relationship between fitness and anthropometric data (Montoye, 1955). Miller and Rhyll (1964) found that the metabolic cost of work steadily lifting the body was increased by obesity, and that this cost was predicted more accurately by gross body weight than by fat measurements.

Previous work has failed to show any impairment of aerobic tolerance as a result of exposure to hypoxia. Davies *et al* (1976) found no change in aerobic capacity in subjects using a bicycle ergometer during and after exposure to a carbon dioxide partial pressure of 3.8 mmHg. This experiment in which hypoxia was simulated for study has also simulated the environmental conditions found in the submerged nuclear submarine. Smith *et al* (1971) found no impairment of exercise tolerance during either acute or chronic exposure to 21 mmHg carbon dioxide. Krueger, Womack and Welch (1966) measured work on a bicycle ergometer in a hypobaric atmosphere with a carbon dioxide tension of 7.6 mmHg for 3 hours. Again, no change in aerobic capacity was found. It seems unlikely therefore that the 20-4 per cent decrease in mean RFI recorded in this study was due to hypoxia. A more likely explanation is that lack of physical activity led to the decline.

The association between smoking and poor aerobic performance has been well documented through the mechanism



Table 1  
The effects of smoking on CO and stroke volume in 10 subjects

Subject	Age	Height (cm)	Weight (kg)	Mean values before smoking				Mean values after smoking	Mean values after 10 cigarettes
				Stroke volume (ml)	Stroke volume (ml)	Stroke volume (ml)	Stroke volume (ml)		
1	25	175	70	100	100	100	100	100	100
2	28	180	75	110	110	110	110	110	110
3	30	170	65	90	90	90	90	90	90
4	32	185	80	120	120	120	120	120	120
5	35	175	70	100	100	100	100	100	100
6	38	180	75	110	110	110	110	110	110
7	40	170	65	90	90	90	90	90	90
8	42	185	80	120	120	120	120	120	120
9	45	175	70	100	100	100	100	100	100
10	48	180	75	110	110	110	110	110	110

involved system (Goldberg, Kasse, & Kasse, 1970) demonstrated an increase in cardiac output and heart rate accompanied by a fall in stroke volume in exercising subjects following cigarette smoking. This contrasts with the situation in the subject at rest, in which cardiac output is followed by an increased stroke volume and cardiac output with a relative bradycardia. Smoking may thus have a depressorotropic effect on heart muscle. Other suggestions have included partial hypoxaemia due to obstruction of pulmonary function and the effects of carbon monoxide on oxygen carriage in the blood or on peripheral tissue utilisation of oxygen (Kramholz and Hedrick, 1972). American naval physicians (Barnes, Gundersen and Blake, 1972) have suggested that smokers have an unfavourable attitude towards sport and that cessation of physical activity contributes to their loss of physical fitness. This approach may explain why in the present investigation smokers had no reduction in stroke volume after 10 cigarettes. This preliminary field study has illustrated the deleterious effects of smoking and prolonged inactivity upon physical fitness. There is therefore a need



for more study of the effects of smoking on fitness and of means of preventing the deterioration that accompanies physical inactivity alone.

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## Search and Rescue — The Medical Viewpoint

B. T. Jolly

### ABSTRACT

West RN medical efforts in 1972 are related to four cases in which rescue in flight is a hindrance to medical treatment compared to a beach and shore (SAR) rescue. It would be very difficult to humanely prepare and equip for the rapid emergency but by combining SAR activities (based on the aircraft operating from RNAS Culterton) during the period January 1972 to January 1973 and analyzing its data with a data bank a medical viewpoint of how to improve rescue is suggested and could be used.

### Introduction

RMS Seahawk (Captain S. Leonard OBE RNVR) the Royal Naval Air Station at Culterton in Cornwall and is the largest helicopter base in Europe. From 1972 helicopters from this station were simply provided for SAR tasks in the Southwest as available request from civilian authorities. The appropriate skills were considered to be part of Service flying and indeed still are but these arrangements were terminated on July 1 1972 when MOD (R) contracted with the Department of Trade and Industry (DTI) for Culterton to provide designated aircraft for two different civilian profiles.

At under 30 nautical miles range at 15 minutes notice, during daylight hours only.

Up to 100 nmi at 90 minutes notice with an all-weather day and night capability.

Our controlling authority was the Southern British Command Centre (SBRCC) at RAF Manston (Plymouth) but initiation of local SAR flights was usually by HM Coastguard or Police request.

### Aircraft

The SAR Wessex 1 of 771 Squadron Naval Air Command has a quick start up facility. Its duty crew of pilot, aircrewman and crew are dressed for flight and the aircraft usually airborne within ten minutes of the Tamar order to 'assemble'. With a single engine on capabilities are somewhat limited in range endurance and payload but the rapid response is almost invariably helpfully to save life. It is ideal for the primary local task. The Westland Sea King however is much bigger and carries two pilots, two crew members and a control system that enables it to fly and land in darkness, bad weather or fog. It has proved the ideal machine for long range SAR work despite its primary employment as the Royal Navy's air sea lifeline (ASW) aircraft. This has been borne by the Royal Air Force's current purchase of fifteen examples of the SAR version already in service with the Belgian Air Force, the Royal Norwegian Air Force and the Federal German Navy. The Sea King's equipment has been further enhanced by several during service in the Mersey Emergency episode when most of the crew of a captured Danish coaster were saved by aircraft operating in appalling conditions from RNAS Culterton (Fig 1).

The RN Sea King training squadron 706 Squadron NAS (nowadays most of the DTI service) in addition to its normal tasks. There is an added advantage in that most of the duty crews are made up of experienced aviators who are enthusiastic about their



Fig. 1. *Etendard* (see *Amphibious*) on 10 days after our expected date of French capture after *Evangelos*.

occasional life saving role.

#### Physical Problems

The crew roles of a Sea King varies tremendously, especially in the lower end of a cold, dark, noisy and often wet place in which to practice medicine. Yet it may be vastly better than the royal deck of a small fishing vessel lying low to its beam sea. To contribute successfully on a SAR sortie an MD must be fit and confident in order to get down on the deck in the first place, capable of exploring sea and the vessel's limited facilities to the full, and competent to improve and then maintain the patient's condition during watch up and transfer to shore. It pays therefore to be familiar with the vessel, the equipment it carries and its operating techniques. This applies to the Frigate Squadron MD as much as to the medical staff of an Air Station. The need for fitness is readily apparent from the following incident.

On January 24, 1975 the DTI Sea King was launched in an area 120 miles west of the Solferino in response to a call from the French cruiser *Etendard*. In 400 yards in a 30 foot wave five attempts were made to lower the MD to water

a crew member with a head injury. Each attempt was complicated by the rolling and pitching of the vessel which in turn caused the two main and outer edge cables to stretch wildly and unpredictably. Dangle was eventually completed by lowering him down to an aerial chapsal and then moving over the deck. This allowed the MD to hook off with his feet against the mast and find with the medical bag against side and gunwale. When he proved no shock he was treated in great haste, braked and near submersion. He then found that the transference had contributed to his severe head injury.

Figure 2 shows a typical transfer during good weather to a Greek freighter. The Sea King (SAR version) however was used whilst MD and equipment being suspended in hoists. That machine and man are used in the stage is further highlighted by the following account of a mission during August 1976.

*MD Evangelos reported a badly*



Fig. 2. *Dangle* of doctor and medical store to Greek freighter.

upward climber on a cliff at Pordugas on the north Cornwell coast and the SAR Wessex approached with an M20 on board. The cliff moved vertically the 275 feet in this process and on arrival the upward climber could be seen on a ledge about 30 feet above the sea working first aid from his colleagues. With the helicopter hovering at full power and facing the cliff a 1000 foot search down was completed. The rescuer took two minutes to stand setting up a procedure similar to the search more used for M20 and equipment in a boat weight. During this lengthy period the whole area was covered by the persistently incandescent searchlights of rescue jacks whilst hovering at the height. Sadly the officer, a young medical student, had died of a massive heart attack before the day.

It is also worth pointing to have as many responsible medical staff as possible at hand for their survival and safety equipment skills for they will then be available to accompany to provide offshore medical cover. At Calshot all three medical officers and the two Port Officers Medical Assistant<sup>1</sup> come into this category. On one occasion the wisdom of these preparations was reinforced.

A violent storm struck the French fishing fleet 120 miles west of Calshot in the afternoon of Sunday March 12 1976. Several fishermen were washed overboard, one vessel was damaged and another had to be abandoned. Using coils of wire from Calshot, two Sea Kings were kept stationary only in the area from 1400 till they used 1900 the following evening. One carried an M20 to provide medical assistance for any casualties required. The two M20's worked close for just under 18 hours with but unfortunately there were

no survivors from the external accident.

Once on the deck with his medical equipment safely located, a different set of problems faces the SAR M20. Language barriers often seem insurmountable as a large international fishermen crew usually at the interested figure nearly disappeared from the sky. When there is time to do so, study of an appropriate phrasebook before take-off pays dividends, as does the coverage of a copy of the International Code of Signals, 'INTERCO', an HMSO publication which contains an internationally agreed set of flag and light group signals for use when medical advice or assistance is sought on the high seas. Even a large windsock and pond have proved the vital basis for a simple drawing to make a message clear.

Getting a casualty up from the scene of initial injury may be the next difficulty. A quick 'man-over' on the requirement deck with a hand held torch may not reveal a complication that can be worsened during hoisting up to the main deck. It is far better for the patient to be placed in a Stokes basket or Port Robinson stretcher and moved in a controlled fashion to a well lit and sheltered location where more thorough investigation can be made (fig 1). In some circumstances of course that may be the aircraft itself.

Occasionally the problem that first named the casualty may reach out and strike at the working M20 herself.

On November 18 1977 a customer ship, the *Sea Frontier*, sailed from 180 miles out then four crew members had been rescued by James heading from on men of cargo in the hold. The SAR M20 found them severely distressed. 30 cold fresh blankets were sent and ordered them to be wrapped up and taken straight to the Royal Cornwall Hospital at Truro. Their condition and treatment have been reported elsewhere (Williams et al 1978). Twelve of the crew were found subsequently to have

<sup>1</sup>There is the added option of Port Officers for category 3 (H 1981, p 267).



Fig. 1. Micrograph showing cross-section of a plant stem. The central vascular cylinder is visible, surrounded by cortical cells. The image shows the internal structure of the stem, including the vascular bundle and the surrounding tissue.



Fig. 4 Patient comes to deck ready for a cut up.

been affected by the heat, you cannot recover from a looking but unhit patient. The MD's own memory revealed rapid exsanguination and a high reticulocyte count which fortunately returned to normal after about a month.

Having remained in the dark with his patient properly covered, the MD may be thrown further back on his heels by the discovery that his helicopter has returned to base without him.

After a 220 miles ascent to the cargo vessel *Idroplan* off the coast of Ireland, a medical officer was washed down to island in an Indian summer rain, had suffered a myocardial infarct. The *Sea King's* later run was much reduced by the fuel at this extreme stage, and because the weather was worsening rapidly at Chidley a sea rescue. The MD had an unexpected sight as two lifeboats carrying away his patient to Tréboul in another aircraft the following morning.

Further diversion is also possible at this

stage, making the savings of a small amount of paper money, identity card, toothbrush and a change of underwear all in fifty possible permutations.

When an explosion destroyed the bridge of the tanker *Assia* on July 24 1977 30 miles off Brest, there were many casualties. The submarine HMS *Oppenheim* on passage in the area alerted to the scene and rendered the most severely injured. One MD was sent to the tender and another to the submarine. All possible medical treatment was given and the *Oppenheim's* patients landed at Brest and transferred to the care of the French authorities. As the submarine then had to sail immediately its medical officer was left stranded with no motor, passport, accommodation nor means of return to England. The French Navy came to the rescue, however, and the following day flew him home from Brest and before then it is understood his sister of obstetrician ran and flying before raised no more questions!

Even if patients are severely ill or badly injured it is worth while treating them about the water up into the nearest aircraft. This is best done while lying the life jacket and one defender, the latter as frequently forgotten. It is recommended that all E&B medical personnel experience a stretcher lift themselves to remind them how lightweight the proper movement, using engines and sliding, must be done etc. It is particularly helpful to an anxious patient if the medical officer actually rides up with the stretcher in a double lift harness and can then safely see the aircraft's two hoists (engines).

The rescue phase now begins, during which the patient's condition may rapidly deteriorate and require therapeutic action evaluation.

As a result of a motorcycle accident outside the gates of HMS Exmouth, a

young LREM sustained a fractured clavicle and ruptured spleen. He was immediately transferred by helicopter to Trellick with an accompanying MO and a PGMR. During the 16 minute flight his pulse became very fast and gross pallor developed. The insertion of a large bore cannula was made surprisingly difficult not only by the collapsed state of the veins but also by the shocking instability causing the veins on the chest skin. Rapid infusion of a litre of Rhomunelectro restored the pulse pressure and he subsequently underwent a successful splenectomy soon after landing at Trellick.

A change in the patient's condition can however be less dramatic but even more difficult to manage.

On February 13 1979 a 23 year old man with fulminating acute hepatitis was transferred by Wessex 1 from the Royal Naval Hospital, Gosport to the Little Port in Bristol. There were two concurrent problems of interest and unique situations arising in addition to a collapse. During the 90 minute flight he passed on and one of a team experienced state that caused his attention considerably. All materials that came into contact with the patient were treated as potentially infectious, a problem further compounded by the failure of the cabin door to close properly causing a considerable draught. At one stage he vomited and nearly aspired the situation being averted only by the portable suction operated manual sucker. All communication with the patient was interrupted (Fig 2).

Prior to HM a was, agreed by all authorities concerned that conditions posed up west of an arbitrary line running from north to south through Caldey should go to the West Carmarthen Hospital at Pwllheli. However Trellick is the bigger hospital with a large playing field outside



Fig. 2. Communication problems with HM a d and patient during transport to Pwllheli hospital.

the main shore and the local fire crew are unfortunately about proceeding over the L&E Maritime headlands. It has many facilities for specialist attention but it does lack one important support discipline, it is a neurological unit and the following medical illnesses that a little outlay of thought can contribute to a successful L&E team by ensuring that the patient is transported to the best possible facility for his or her problem.

In answer to a distress call from the Fleet Tender *Revel* 16 miles west of the Lofies on November 18 1976 the HM Sea King was launched from Caldey with the duty MO on board. He found that a crewman was hanging following a fracture of the cranial base induced by a crushing blow. The man's condition improved while being treated where but a broken apparatus that could not control pressure due to a depressed post pressure was in need of urgent replacement equipment. Knowing that three facilities were only available in Pwllheli the MO requested an emergency diversion of the voyage to Pwllheli Health Hospital. As a result of the short delay between injury and treatment recovery time that day proved very successful.



Finally, in this short account of some of the medically directed SAR missions flown from California, comes the amazing tale of the Libanus registered tanker *Bochum* (C-3300) (2-660) now, on a passage from the Middle East to Belgium, On September 26, 1977, while off Cape Flomare, her master radioed Laramie End with a Medevac request for one of his crew who was suffering from Smallpox, Yellow Fever, Cholera and Typhoid. He was advised to make for the nearest port but refused. The French authorities readily declined to accept and to do so. The following morning the tanker anchored off Bochum and the Port Medical Officer downgraded the diagnosis to the less hazardous one of a mild viral gastroenteritis from which the victim had by then completely recovered.

#### Equipment

In Figures 6, 6B, 6C, and 6D, a front of two King BN 600 of 7th Squadron with the SAR medical stores, wearing one piece pressure suits with rubber soles and wrist seals, with the life preserver waistcoat and one crew dangle packs on the ground. Figure 7 shows the lightweight stretcher, a Raingway pack of waterproof nylon material containing dry blankets and simple first aid kit, together with a sheet of foam plastic which provides thermal insulation and comfort for the patient. A spare lifejacket and a pair of ear defenders are also visible at the head of the latter. The workable medical stores are on a canvas EMU pattern carrying sheet on the foreground.

The white box, marked with a dayglo red cross, is a sheet metal constructed by craftsmen of the Naval Support Support Unit at Califorma. It should be emphasized that any box will do provided that it is light and strong. Planking it in two ply plastic cases containing the Victim Modulator and Laramie medical equipment. The former has been modified by us to carry in addition a Fiedler hypoxymeter and a range of sizes of



Fig. 6 Medical stores and life preserver being hoisted by helicopter.



Fig. 7 Medical stores and life preserver on stretcher. (See Figure 1, 6B, 6C, 6D for details of stores.)

radio-activated cables and antennae to enable reception and subsequent pressure preserver ventilation to be carried out either on board or in the aircraft. The system apparatus is very light and easy to use and has a rechargeable battery and although exposure at 450° has proved life-saving on several occasions.

There is little point in describing the exact contents of the Califorma SAR box because there will obviously be considerable variation in individual requirements and preferences.

I have hitherto summarized the main clinical problems encountered in the Western Approach during the last six years, though not in any particular order of importance or frequency. It is also worth remembering that, particularly with vessels 1 to 5, there may be multiple casualties requiring extra equipment and personnel.

**Possible Clinical Problems**

1. Intoxication
2. Fire at sea, with electrical or fuel source
3. Great trauma secondary to explosion in a confined space or its associated equipment (e.g. pump gas supply)
4. Toxic fumes
5. Fractured limbs (which may be trapped)
6. Head injury
7. General surgical conditions (acute appendicitis or strangulated hernia)
8. Medical problem (other pneumonia associated ecthyma, acute toxic psychiatric disorder)
9. Acute gynaecology (ectopic or ruptured ectopic pregnancy)

Some of the above conditions are occupational hazards of working at sea others are also common ashore but take on greater proportions 200 miles from land. The last category may appear surprising but there is an increasing incidence of women at sea on merchant ships, on crew members (particularly in Eastern bloc vessels) or as travelling wives.

**Medical Equipment**

In addition to the induction and suction apparatus, previously described, the following items deserve a place in the SAR MD's stores:

- Endoscope and curved sphygmomanometer
- Thermistor
- Space torch with red filter for preserving night vision
- Intravenous cell protectors at least sufficient to perform an aminocaine/CsCl and epinephrine infusion in every outbreak
- Infusible hot spouts for lower leg, whole leg and arm
- Reck oxygen burn dressings (one large one small)

**2 space Markers**

- Harmon combination colour test strips
- Disposable colour changing wet
- Cage: Kling and champagne bandages of various sizes
- Pinball game or Solitaire
- 2 bottles low molecular weight dextran and giving sets
- 2 plastic packs of 5 per cent dextran saline (e.g. Bionell)
- Intravenous cannulae of choice
- Selection of syringes and needles
- Prepacked silk and catgut
- DENTAL box
- RT PA box
- DENTAL box

The last three items can be generally based under specific pharmacological headings, together with a suggested representative of the class:

Antibiotics	— Ampicillin
Antiemetic	— Metoclopramide
Anticoagulants	— Vitamin K
Anticholinergics	— Pilocarpine
Analgesics	— Morphine/ Ethinorphone
Antacids	— 2% Lidocaine w/o m/v adrenaline
Bronchodilator	— Aminophylline
Cardiac	— Atropine
	— Lido
	— Adrenaline
	— Xylometazoline
	— Hydrocortisone (Sclerostin)
Nervous	
Other	— Diamine UV
	— Epinephrine
	— Xylometazoline
	— RT jelly
	— Water for injection
Dental	— Euphoric dressing material (e.g. Cavil)
	— Dental springs and rings and needles

<b>Glycolab</b>	Phosgene
	Ammonium
	Airport (all Masses)
	Tropical antibiotics/
	stereos mixture of
	choice

Manure is extensive in aircraft safety and may form a toxic vapour at altitude as thermometers must be very well wrapped. Manure material devices such as Tensate are now commercially available. For the same reason, the glycolabometer should be stored rather than measured. In case of disaster, work in the line of the medical store during transfer. I had large pockets added to the legs of my trousers not for a small infection of the drugs mentioned, in that something would be used.

#### Results

During 1976 122 SAR missions were flown from Cribstone, mainly by the Wessex 11 of 711 Squadron, an increase of 27 over the previous year. The variables were for the most reasons — people cut off by the tide, variations in difficulty, decreased pleasure craft and badly defined objectives. The typical 'silly' seasonal variation was also well shown — July and August always being a drop of calls seemingly caused by increasing the Atlantic on Lake. Perhaps less well known are the figures for the numbers of SAR missions actually accompanied by an SAR.

1974	18 (including final a/c crash 4 failed)
1975	21 (including final a/c crash 3 failed)
1976	26

The last figure shows that 15 per cent of all SAR flights (mainly the long range ones) from Cribstone during 1976 were capable of giving the very highest standards of conversion to the sick and injured. This is a figure that the Medical Branch and the SAR organisations can be very proud of —

the problem of carrying an MD and his equipment on board an offshore (these standards is at present in Britain unique to the Royal Navy and Cribstone).

The number of people rescued during the period was 47, with 7 bodies recovered. Some of these undoubtedly had their lives saved by SAR heli-rescue, others might well have made it by other means. The distinction is an important one when deciding prevention or comparing results. Because within the RAF the RN does not report every successful mission as 'life saving'. Looking at the figures in yet another way, I estimate the number of deaths actually prevented by the timely arrival of helicopter borne medical help to cover the effects of other serious disaster or injury during 1976 to be 9, i.e. 11.5 per cent. Despite our share of disappointments this figure represents a satisfying and worth while result.

#### Postscript

During the preparation of this article another incident occurred which has highlighted an earlier point about the value of being familiar with the aircraft and its operating techniques.

One highly important feature of the Sea King is the facility for emergency lower torso control, whereby a small joystick by the main door can be connected into the main flight control system. The word operator can then guide the aircraft gently towards the spot he requires, under direct vision. It is an unpleasant sensation for the pilot to have to hand over effective control of the aircraft in this manner, but sometimes it is the only way to achieve success.

On February 13 1977 the French tender *Exploit de Bretagne* struck the rocky 2 m E of the Bonting's Rock Lighthouse on the Solent. The vessel broke up and the crew jumped overboard. When the RN Sea King arrived on scene at 0528 there was no



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## Doctor at Sea?

B. A. Graham

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Perhaps it was that general practice seemed not suited a way of life in my late teens. My 3000 patients of local million £ miles of my surgery and the prospect of sharing this area with them for the next 35 years seemed to lack the promise of excitement that youth expects. Each day of the week had mounted its own fixed routine. After 14 years of study and work within the National Health Service I wanted a change of emphasis... diving or creating medicine. I answered "Diving" my interviewer asked: "We'll send you to submarines."

As it turned out, I am extremely grateful for that decision. Of course it did not take me long to realize that the medical officers of a Polaris submarine has very little to do with diving. But it gradually became apparent to me that in the challenge of Naval Medicine there was more than first meets the eye. Not only must the submarine medical officer be able to carry out his clinical duties, but he must expand his outlook to include the scientific and engineering principles underlying the environment in which he goes to sea. He has to sharpen his recollection of units from science and apply it to atomic physics and reactor design. A study of the effects of radiation on cellular biology will be useful for interest in some medical sciences, and this horizon further expanded when he learns about the effects on organisms and material structures of being in relatively high concentrations of the gases of carbon. Later on when he has time to stand back, he finds that much of

the new knowledge that he has acquired extends beyond submarines to the worlds of aviation, diving and occupational medicine.

So I found myself in a Polaris submarine. Quite where I was in the ocean I did not know. But it was just that uncertainty that made the job a challenge. That and the total reliance on strictly help from outside sources. Collectively we had many skills related and in some cases were obvious duplications. We knew from our own and literature neither submarines that hostile physics and atmosphere problems can be managed by engineers, though without the insight how the medical implications that our professional training allows us. Nor are our boats totally dependent on doctors for medical advice as the medical ratings onboard are trained to cope with most of the day to day minor diseases as they would on a Regent.

Why then, in this period of scientific difficulty and manpower shortage in the Medical Branch are doctors sent on detours parallel? Part of the answer has already been given. Our background better enables us to interpret hostile physics and atmosphere data as an assessment of their effect on the efficiency and well-being of the ship's company. We are also able to advise the Command on a range of medical and para-medical subjects, hopefully with more confidence, authority and a greater depth of knowledge than our medical ratings.

Our major reason *afire* must be, however, the "insurance policy" against the

disruption of the peacetime staff by surgical and medical incidents. This is not to say that the conditions need necessarily be life threatening. A considerable effort may well be made to avoid serious and avoid a patient with any a broken arm to avoid long-term disability. A medical officer could probably treat such an injury satisfactorily at sea. Nor does it imply that the presence of a doctor onboard is the solution of all those with major burns, fractures or injuries. What it does do is to give such patients a chance of surviving the period of time, perhaps several days, that it might take a civilian sailing officer to clear his period arm and move to a position within range of land based help. It was these few days that formed for me the challenge of being the medical officer of a Polaris submarine.

Quite clearly the challenge had to be met before the boat sailed on patrol. The State of Medical Stores for Reserve Affairs of course, provided a sound basis on which to build one's medical resources. However, a doctor's widest relief is a considerable extent on his experience, the level of which is unique to him as an individual and which includes the use of a relatively small selection of the vast range of drugs and medical equipment available today. It follows therefore that before entering into any detached duty situation the medical officer must ensure that his experience is reflected and enhanced by appropriate additions to the existing stocks. Before equipment can be used he must be quite clear as to the limits of his experience and make whatever plans he can to tackle any situation arising outside these limits.

With that in mind, I found it a useful personal exercise to consider in broad outline the various problems that I might have to deal with. Research into experience in electrocardiograph machines and a good range of books were already referred to help cope with acute medical problems, and it

only remained to check the drugs that I might require. I had already resolved to take the advice given by RSH Butler that except at conferences during a Polaris patrol would go on all but the most desperate of cases do more harm than good. I therefore accepted the surgical book as being adequate, ensured that it was all indexed, stored it away in a ring-binder and prayed that I might not need it. To help this prayer along, I checked that I had the means available to treat common acute surgical conditions medically. Obviously the facility to "help and suck" featured strongly here. My own lack of practical surgical training made me feel more sympathy towards my potential trauma victims who might require "helping up" as a last and measure of nothing else when it was. So I reviewed a variety of drugs together for regional anaesthetics, various intravenous fluids and a moment of extreme precision for a simple personal assembly.

Perhaps the most satisfying situation to plan for was that of a trauma injury. Injuries from mines can occur on Her Majesty's Ships and it seemed quite likely to me that an accident involving mines could be the most likely source of a severely injured patient while on sea at sea. Further, it was not unreasonable that I might be faced with two casualties from any one such incident, and that their bodies might be of such an extent that the provision of fairly energetic if not basic supportive therapy in the immediate post accident phase may enable them to survive the period of time it would take to extract them from the dangerous patrol situation and transfer them to more sophisticated care.

Once again a major limitation on this support was bound to be the lack of expertise in this field onboard. A second obvious fact which came into my analysis, Flammation and an adequate supply of sterile dressings were fundamental to the treatment of burns

However, the provision of a facility for fairly extensive intravenous therapy was clearly just as important a tool, and as thought had to be given to both the type and the quantities of intravenous fluids to be used, it is of interest to note that, in the limited space available, my difficulty was concentrated in drawing more than 10 litres of assorted intravenous fluids onboard.

Having accepted that parenteral therapy may be required, it was then necessary to consider how best it might be effectively controlled as a function derived from modern laboratory support. Does a low haematocrit indicate over hydration, a pre existing anaemia, or red cell destruction as a consequence of the burn? The solution seemed to be to give about 2 litres of non-oxygenated fluids in the first 24 hours, for each 10 per cent of body surface burned, in addition to the patient's normal daily fluid requirements. The possible 50 per cent error of this method would thus be most fully controlled by limiting the volume rate against hourly urinary output, a figure of 30 to 40 millilitres per hour being the target for the first 48 hours (46). Of course, life is never that simple. Murphy's Law dictates that when outside the range would be due to one or other form of renal failure rather than an inappropriate infusion rate. I allowed myself a rare moment of optimism at the point and decided that it would never happen on my last voyage.

Having hopefully established in broad outline a plan to maintain a reasonable degree of hydration in my patient, I then had to consider how it could be improved to the benefit of the patient. Certainly the use of plasma and plasma expansion, both of which were carried onboard, would be of value in treating, or correcting, hypovolaemic states. In the case of plasma, there would be the hopes of replacing some of the plasma proteins lost as exudate from the burn... But what of blood? An over-

perant haemolysis of fresh blood was precluded on board by the ship's company. All per cent of volume blood groups were known and entered. Obviously in theory there should be no difficulty at cross matching and transfusing the patient with blood from this source. Practically, however, it was clear that the unimplemented facilities available onboard would carry a risk of an incompatibility reaction greater than that normally accepted ashore. If my patient had no far reached renal failure from oligaemia or haemoglobinuria, he would not drink me for sticking the needle up into his arm. The indications for blood transfusion in the present situation obviously had to be weighed even more carefully than in normal clinical practice against the risks it presented. Previous experience made it possible to monitor haematocrit and red cell concentrations and packed cell volume. Although used individually each would have been inaccurate, used together they would give a reasonable assessment of any haemorrhage covered by the burn. This, in fact, together with the clinical picture, could then be monitored downwards to the point at which the risk of transfusing the patient was outweighed by the general deterioration in his condition, due to the acute anaemia present, and the effect that this might have on his ability to withstand CASEVAC by helicopter. The balance seemed to be that, in view of adding blood to the infusion system should only be accepted when the condition of the patient indicated that he needed at least 5 parts of the solution.

The provision of some assistance of laboratory back up for clinical work during the period seemed considerable attention before we left Falmouth, and these provisions were "minimal" at one to ensure that they could be successfully carried out should the need ever arise. In addition to estimating the parameters listed above, when blood cell and differential counts could be

performed and blood films examined. Asbestos tape covered after waterproofing and of relevance to burns was bacteriology. After much telephoning around the country the best's incubator which had been listed as "service no longer required" at some ill defined point in the past was found and eventually installed in the wing-beds of the sick bay. A good microscope was already available onboard. A supply of Oxoid tablets from which several different sorts of culture media could be made up as well as all the glassware meant. Petri dishes etc. required were collected from sources such as the Institute of Naval Medicine and the Bristol Naval Depot at Gowerack. The shortage of how glassware and culture media could be worked was overcome with the help of the Supply Branch who produced a large pressure cooker. It was then possible to demonstrate that the Engh Avenue documents on prepared medical screening and thought to have been adequately tested at that time, returned desirable as more water taken from the sea and consumed during the patrol. (Perhaps previous administration of pathogens obtained at sea would have been difficult but antibiotic sensitivity tests could be carried out effectively to provide a guide to treatment. Sub-culture of offending marine organisms during the antibiotic before the patient was encountered

from the boat would save time for laboratories, continuing his investigation ashore. Sub-culture would also allow detailed retrospective analysis by short laboratories of bacterial collections tested and consumed during the patrol.

How far does time I proposed in finding job satisfaction since leaving the National Health Service? It would be dishonest to suggest that I have entered a Garden of Eden. But quite apart from the planning resources such as that outlined above almost positive both at sea and ashore in the Royal Navy is infinitely more rewarding than in the National Health Service. The major factor in making this so is the fact that a Naval Medical Officer can give to his patient. But as a sailor from serving in a Polar boat was the grounding in nuclear and submarine medicine on which can now be built not only a broader outlook on these aspects of Naval Medicine but also a more general appreciation of the medical and pathophysiological problems man faces in his environment. It is the prospect of the study of the interaction of the sea at biochemical and cellular level in particular that remains for me the most offered by the Royal Navy.

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## Mid-Atlantic Rescue II

David Rowton

The following account may be of some interest as a sequel to a previous Atlantic rescue (Rowton 1977).

On Monday, September 18, 1977, *SEA Serenity* was approximately 300 miles west of Elm in route for the United States. At about 0700 a signal was received, which had originated in a Green Channel search and been relayed to Loughmoe to the Naval Squadron, reporting some of a person in a distress. We altered course and after about 30 minutes a Force 9 and big wave, sighted a Minot. He gave us a bearing on the yacht and by being round and round directed us to it. A second Minot appeared and dropped three dinghies hooked together by long lines. At about 1000 we sighted the upturned, apparently 17 ft dinghy with the person on. *Santa O Coloma* came on the top. He then pulled his dinghy towards the *SEA Serenity*, dived overboard without a life-line, and made fast the two dinghies before crawling onto the rescue craft. *SEA Serenity* had stopped its westward and drifted down towards the survivor. Struggling man, now landed and the survivor climbed aboard without assistance. He was taken to the ship's hospital where he was put into a hot bath and given a double bandy. He was then given dry clothing and a hot meal.

He had crossed several long yacht cruises in the West Indies but not in Skipper and had visited numerous. He decided he would like to return to Galway by inflatable Ocean (with 5 hp outboard motor) as that

had not been previously accomplished as he sat out under square latex type and steel small motor/motor steering with only a canvas cover giving him 2 ft headroom and used a small water gun stove for cooking. He was 50 days out approximately 3 000 miles from home when, while asleep, he suddenly awoke with a great wave in possibly a while. He was tangled up in ropes and was in the dinghy but managed to scramble up on its bottom and proceeded with some remaining food and drink while waterbirds attacked the dinghy for the small harpoon, but were dispersed. He tried to right the dinghy by deflating part of it but to no avail and was therefore stuck on the upturned dinghy with his feet in the water for two days. He had sent up flares and his automatic Mayday signal which was taken to his mother's net. This had functioned very well.

### Conditions

His general condition was very good although he was tired, thirsty and cold. His feet were normal in spite of immersion in the North Atlantic for two days. It was interesting to note that shortly after he was rescued was when he was on the rescue raft which had mobile flaring. His mental state was alert and normal though he lived rapidly when answering uncomfortable questions from the Press on the radio telephone. He had only lost half a stone since leaving the USA, was thin, small, with a good sense of humour and most apologetic the crossing was till. He had been

partially sponsored by items in the Store and had previously been working as a waiter and a garbage collector! He expressed the wish that if the machine improved he would like to continue by Genova, but was persuaded otherwise and was transferred to factory work, his things and equipment (damaged!!) to HMS Ashburton the following day, and later landed in Plymouth.

#### Comment

As an amateur politician I cannot but feel intense admiration for the undoubted courage of all who attempt to sail solo across the Atlantic but perhaps of unproven

at all for certainly a claim might be started to cover the incredible expense involved when ships other-come and soon at full steam to their destinations, and especially for the expenditure of fuel for long distances overall!

It is surely a matter of opinion as to whether this form of sport is really profitable or merely costly, but supposedly it "Gains control the system"

Charles A. Morgan

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## Frankie Wild's Hat

A. G. E. Jones

Frank Wild



*An officer of the Royal Geographical Society*

When the *Endurance* sank in the middle of the Weddell Sea in October 1915, Shackleton had the problem of housing his officers, sailors and men born ashore with three boats and very limited stores and provisions. Even so, everybody was optimistic. Captain Oates, Lt. Royce Marston, the motor engineer, came in his last diary:

*All rather cold but cheerful and full of hope & general confidence in Sir E. 29 October 1915*

Commander Lionel Gonsworth then Second Mate in the *Endurance*, when asked whether the party had any doubts about Shackleton's ability to get them home safely, replied with an emphasis: "No." The trust in the boss was one of the important factors with the expedition in the two arctic months.

When the ship went down and they had salvaged more than they could carry, Shackleton started the march across the pack ice but soon gave up when the work was found too hard. They camped and waited for the current to carry them north. At Christmas, when they had a few luxuries added to their rations, figs, jam, marmalade, baked beans, oranges, canned peaches, mackerel, glass, pencils and cold mutton, besides the usual provisions and meat, bread and rum. Shackleton believed firmly in good living as a way of keeping up the spirits of his men.

The five boats up and they took to their boats, the *Esperanza* (19), *James Caird* and the *Durley Docker*, and after three rough days at sea they all landed on Elephant Island, where they lived for 137 days.

After a week Shackleton set out in the *James Caird* for South Georgia to get help. He took Frank Worsley who, whenever his other shortcomings was a superb navigator who could be trusted to get a good map drawn in the worst conditions. Tom Crean, who had been in the *Endurance* twice before, a fine man of whom Shackleton thought highly, also went. The carpenter was an

older man and a different, and Shackleton took him away from the main party. Jack Vincent A. B. was not entirely fit and would have been a source of trouble on Elephant Island, so Shackleton took him at his word crew. After an outstanding journey to South Georgia, which he named Shackleton eventually brought relief to his party.

#### Frank Wild

At first Shackleton thought of taking Frank Wild with him, but on second thought he concluded that Wild was the only man who could hold together an assorted party of men, some merchant marine officers and men, and some young recruits who had not been farther than a university, and one regular Marine officer. Indeed Wild was the best man for the job. With many years as merchant ship, and still drawn from hard work on P. & O. Lord Ramsey's *Janabara* and the Royal Witch before joining the Royal Navy he had been on three previous expeditions. Small and wiry he could stand on his own feet and could have dealt effectively with any man who challenged his authority. When somebody was plotting against him, he threatened to shoot the culprit if he found him and he certainly would have done so.

In 1911/12 he had been in charge of Marston's Masonic Party in Queen Mary Land and there he had learned leadership by discussion and agreement. He was known by many as "Frank" and it is striking that when photographs were taken Wild sat modestly among the bulk, though there was no doubting his authority.

#### Captain Thomas (Dick) Lee, R.N.

Lee was not at place in such mixed company. In the best journey he had shown himself to be lazy and cowardly. Once when he was told to sail engaged in an arduous system of traps and was of food with officers and men, and then complained when Wild stopped all exchanges. He

wrote

*There is a slight up against me to whom Wild gave me much food. I was called a Jew - (18 June 1911)*

And a couple of months later he wrote of his ship

*Strong sickness very now formed. This is bad. (25 August 1911)*

Concurred has no memory of illness and the complaint did not come up among the others. They indicated him and L. D. A. Henry in a poem on June 19 1911 laughed at him.

*When the Colonel says all his was food in one day and when I said that on the shore and High down up he never. Since you know the Colonel's poem not.*

When he complained of such references, another poem was written about him. He later years he told how he was to have been the first of the party had been reduced to consideration, but he mentioned that only in his later years when he was obviously failing.

#### Cape Wild

At my time Cape Wild, on the north coast of Elephant Island, would have been an interesting, low lying spot, about 500 yards by 30 yards, above the high water mark but backed by cliff and higher that could not be climbed. But there was there the end of a small headland at the northern end of the spot there was a large colony of penguins and penguin proppens, and the birds and sea food allowed work to come ashore. And it was free from the rock falls that had made their first camp, at Cape Valentine, so dangerous. Today it is marked by a beacon.

The weather was the most important matter in their daily lives. Elephant Island lay between the usual depression tracks so that it avoided continuous bad weather. Only a few days could be called "brass" or fine, but one day in four was dull or very

mild and then the clouds usually came up at noon. On a few occasions they were able to carry their sleeping bags outside to dry in the sun, but they were never completely dry. On the other hand, they had blankets for a quarter of the time or they had snow and the skins were often covered. At some time or more days the air was full of snow dust and frequently there was wet snow. In April they had a terrible wind storm that swept down the glacier, carrying out to sea any gear not weighted with heavy stones. In May they had blizzards with winds up to 100 miles per hour. Dr. A. H. Muehlen described:

"A more deleterious phase could scarcely be imagined. The gusts increased in violence and became so strong that we could hardly walk against them, and there was not a line or sweep of abster vegetation. Occasionally small clumps of ice were hurled through the air."

Fortunately, Elephant Island was out of the cold current that swept north from the Weddell Sea and consequently the temperature was bearable. From 32°F in April up to +32°F in August on average. In August it was not unusual for the thermometer to be above freezing point, but even then, the humidity and their poor clothing made life hard for them. On one day at the end of August, Lees was able to sit outside and Martin took a sunbath. On one occasion water at the post. Lees found it too hot in the hot. There was even one day when Lees forgot his customary gloves and became almost frostbitten.

"Mapleloom yellow cannot run at a good pale yellow color after resting in a mass of yellow fire after the constant snow above up it was in the middle of a crimson stain. When close to snow. Many days long appear pale violet or pink, and a deep orange or yellow powder behind few golden. A blue glow with a tinged. Remarkably clear horizon. Part of the day may flourish after a struggle of snowing above with clear pink in. A good deal of snow on their d-

pack on horizon. Last reports on glacier at first morning for sleep sleep from 10 June 1944."

There was only one other such day.

Blizzards sometimes kept them in their huts for a day or two at a time, which they found dull, monotonous and unpleasant. Sometimes a bit cold weather a thick glass formed on the outside of their huts but they also had an appreciable number of sunny days.

To the party looking for relief the ice was the worst thing. It depended very much on the wind. If a breeze from a southerly quarter it brought thick pack ice into them but which was full for just over half the time. Less often there was a southerly wind which cleared the top of ice in the last place. It was not for a time that made it impossible for Shackleton to reach Elephant Island but it was one of those days with a southerly wind that cleared the top of ice August 30, when Shackleton was able to take his men off the island.

#### The Hut

For the first few days they lived in tents which were partly well worn out but after they had arrived at Cape White was quickly decided to make a more permanent camp and a cavern in the ice for the huts. At first they tried building a stone hut but soon decided to erect for two huts on the trail, covering the tops and the edges with ice sticks. Though the weather was still damp, at least the huts gave them protection against rain and snow. But it remained so wet that Lees had to dry his socks against his chest.

The huts were turned into the upper floor giving the ground floor no more than four feet of headroom so that it was impossible to stand up. One of Lees' complaints was of hares falling from the sleeping bags above him, and he rigged up an old coat cloth to protect himself. Nevertheless, the men could see the fatiguing side of their home. B. W. James wrote a song, called "Antarctic Architecture" and

the chairs was

*My name is Freddy. What's your dog's  
in Elephant's hole*

The cook's without a single break and the  
cook's without a rib.

For nevertheless you must confess by  
myself many a mile

*Is it the most natural dwelling place you'd  
find in Elephant's hole*

The big difficulty was to find room on the ground and the theme of the two boats for family two men. Less had his sleeping bag on the ground making a bed of sorts improved with pillows later when the small curved him to look he found half a pound of paraffin must under the bag. In warm weather condensation dropped on bags some of which lost their heat. In storm, still got inside. When the weather turned warmer they found well over 200 gallons of stinking water smelling of guano under the floor this had to be hosed out and a drainage system was devised. Less was not far wrong when he said they were 'living in toilet paper'.

At first the hut was so darkened. Less made a kerosene lamp as a night light which constantly gave him a very clear light without smoke. He was especially pleased when Wild guessed from the use of the night light directly after supper as the ambient light to read. They had very little to read, two poetry books, Nordenskiöld's voyage through the North-East Passage, some two volumes of the Encyclopædia Britannica and Martin's pretty cookery book. After five or three months glass and celluloid windows were fixed, and when the door was open light was reflected from the stove.

Hot food was vital and making a stove was one of the first jobs to be tackled. They installed a small, very satisfactory stove which burned ten pounds kerosene daily. The chimney, made from a Hunsley & Palmer barrel tin, was put through the roof. It became blocked from time to time and the smoke was unbearable. The cook being

blinded, at first it was cleared with a stone on a string but sometimes just passed on James made a fire break from porous clay. Woodbubler was found to give them heat but more smoke which on Less complained, lost his eye. But having found a place near the stove so that he could hang his boots put on the tube greatly improving his health. He was fairly content.

#### Food

When Shackleton sailed from Elephant Island Frank Wild had the problem of obtaining and retaining food. He could not be sure when Shackleton would be able to reach South Georgia and bring help, nor could he guess how long it would take. On July 3, 1916 he said he did not expect the *Aurora* until August while Less pointed to September. A fortnight later everybody was expecting the relief ship and Wild was more definite, expecting the *Aurora* on August 25.

Wild had to realize that the men kept their strength up, so they might possibly have to spend a winter unless they could do something to help themselves. On the other hand he did not want to undermine their optimism by having too big a stock of food. He was constantly criticised by Less who was in charge of stores.

The party had 3,600 Hunsley & Palmer biscuits, some of which had been damaged. There were the dried raisins N.E., N.W., N.P., S.E. and T.M. — whatever they meant — flour, lard, dried milk, barley, marmalade, peas, sugar and prunes dried. There were no limited quantities and by August some of them were coming to an end.

For the most part they lived on what they could kill. Penguins were killed in hundreds sometimes they had to be skinned outdoors and Less was often upset to find his sleeping bag on a pool of blood. Sea elephants, crabs and Weddell seals, Cape penguins, puffins, petrels, rock cod,

fish from postmen's rowlocks. Thousands of hoppers and weevils (which added a new flavor to the food) were their morning. They provided mink, bear, deer, cougar kidneys and brains as delicacies. Nearly all the time they were able to get two meals a day and on a couple of occasions Lenz remarked that they were getting too much food. They had some strange foods (bitter root, Yare) which lived in banks, and beaver food as in a pudding. When the meat was cut up in the kitchen fat of beaverd the house. At midwinter they had a full stomach food with no milk, pudding of powdered beaver, and beaver flavored with eggs, and then a concert.

The party had a meeting for independence and found the most that surviving. They named themselves the men and women. They on their two daily meals were an important event. Wild was over. Lenz noted when he split to get some food. Lenz was ordered of the house.

Depression in sleeping food was not water just. Penman's dinner provided. They were changed. All the food was not as good as the food. (May 6, 1914)

There were other troubles. Lenz who did not get a whole Green the week's rainy now dropped into the house. Lenz also complained of his and got in the house. (May 25, 1914)

Wild could do no right on Lenz's eyes. He did not agree (June 19, 1914) that the stock of meat would last until the end of August. He complained of nervous being thrown away after the best had been cut off. At Wild's suggestion to send a party down "downstream" made for a meal and in particular of the greatest case of meat. The everybody agreed with him. On August 26 he wrote a letter.

Wild as if he had been saying thinking of his own people and how they for whom we have no food. He replied I believe as we do about this song too. (August 28, 1914)

For a man like Lenz who made a habit of having scraps of food for dogs and weevils, that was a change, signs of complaint. Lenz and there were many songs about his postmen (June 5, 1914)

Frank Holey moved again with the house. Lenz did not. That spoke for itself.

There was little or no reference to clothing, simply because they had what they stood up in. The clothing, weevils and weevils were first rule but after months of wear they were getting into poor condition.

#### Shocks

For some time the greatest hardship was the shortage of tobacco. When it ran out they became depressed (June 13, 1914). Wild, Warden, Martin and Muller got away a quarter pig root. Jack Warden the geologist stretched his tobacco and was the last man to run out. The meeting occurred the day for any sort of interesting work on the hope of being repaid in tobacco. When the stock ran out there was a period of depression that almost amounted to mourning. Lenz wrote:

"We all put up tobacco making them very valuable & important. They are almost nothing & nothing. Wild finally got them a small piece each which they immediately smoked. Wild said we may have been very imprudent but as they are always being sold the shop will be done tomorrow it is hardly to be wondered at that they have not got any tobacco by." (July 1, 1914)

No matter what he did, Wild was bound to be wrong on Lenz's eyes. Lenz's Government, First Officer believed that Wild was "in the line", that he got it right.

#### Meals

The maintenance of discipline and the spirit of the party had the making of a problem. The usual practice in the merchant service was for pay to come to an

and when the ship was lost, but although he did not know where the money was coming from, Shackleton promised to pay his men until they were despatched at home. This obviously made them happier, but it also kept them under the discipline of the Master and his superior officers. Even so, some of the men grumbled from time to time and were troublesome. Shackleton took a sensible step in taking five of the doubloons with him on the *Amelia*. Called 'H T. Watson', the navigator became rather dependent.

#### Discussions

The party was kept interested by discussions, arguments and wrangling which stopped short of disputes. Usually there was a Saturday night concert. Some composed songs with local and pointed references to the failings of each other. Henson wrote a poem entitled "What", two of the verses were:

What rank salutes ropes you could hear a  
gun fire!  
When we lie around in pain, quite unable to  
rise!  
When a sense of depression hangs over us  
all  
Then you know that Clarke's just made a  
joke!

When you are a mile shuffling with  
pusching legs;  
And stare of sweat pop through the cloud  
spoke apertures  
When a faint voice pipes out: 'Fill it up  
again, please'  
That's a Wild with his first pint of beer

Clarke, the biologist, was a man who was slow to catch on to a joke and equally slow in making one. On the first occasion, Lenn, on the gun's oil a reactor, introduced the flow as a stream, afterwards saying a song the words of which did not in any way correspond with his action. (E. W. Jones,

June 21, 1915, Scott Polar Research Institute MS 33823). There was an unhygienic spirit forwarded with ginger from the medical store. Henson's things had been taken as 'total nonsense'. De Molloy insisted the medicine and happened Frank Wild's blue hair was so greatly appreciated, all the more so because he knew every strand in the lock.

When they had to lie in their sleeping bags life was dull, but when they were out gathering food the days and weeks passed quickly enough. They were expected to take a certain amount of exercise daily.

Inside the tent one great source of irritation was Lenn's morning cough; though he called himself a light sleeper (E. W. Jones, June 4 1915, JMS 33823). Wild made him go to bed with a string stretched in his arm, which was pulled to wake him up. Wild had to make him remove his bag because two men complained that Lenn had trodden thereon the night. He then wrote in his diary:

This morning one of depression and my  
diary which has been a lot of nonsense.  
For I think I was after construct out of  
paper it was because my morning was  
looming under Wild or Molloy's make, the  
look of them often me up I read for an hour  
during the night and sleep in the  
afternoon.

It was undesirable to the party that they did not have more discipline at their cramped conditions.

#### Shikara

There was no real sickness in the camp. On food landing, many were taken from exhaustion and headache but Green boiled cream milk. Hudson, who had been at the tiller of one of the boats for 72 hours, developed a pain in the left buttock which resulted from ice chunks from which two parts of working food were ultimately drawn. Greenwood had his feet frost-bitten on the boat and Lenn managed them into his. Dr. Macklin was also frost bitten.



Rickman's the strongest' was on the point of collapse. Shackleton's feet were so badly frost bitten that he could not walk, and many suffered from cold water boils. Everyone was rather weak and some were light-headed.

At first Wild predicted that if conditions did not improve some of the weaker men would not survive. Macklin told Shackleton that some could hold out for a month. Rickman's back and Greenstone's feet were slow to improve. Kent had a tooth that had to be taken out by Macklin without anaesthetics, while Wylder's hand became infected. Houston developed bronchitis. But when relief came four months later the party were generally well. Wild ordered his back belt to be cut the side but the only a few days. Less complained of no more.

After a couple of months it was decided to amputate some of Shackleton's toes. All hands were turned out of the hut while Macklin and McInery with Wild and Hurley as assistants took them off. They built the temporary hut up in 1897 and gave him chloroform for his nerves. The health put was used to stabilize the instruments, and afterwards the doctors used the remaining hot water for half a week. The only weak cog of them had when the loss of the *Endurance*. Shackleton made a good recovery.

There very few more his less called of doubtless kept them free from scurvy. Shackleton had long known that good feeding was one way to contentment. He had also learned in the *Discovery* and proved on his polar journey of 1901-02 that fresh meat was the way to avoid scurvy: a point that he made to Milling before leaving England. He used Dr. Gresham Hopkins' meat almost exclusively of witnesses to support his point. Meat treatment helped any faith in them but to comply with regulations, he took some good capsules, but they were never tested. On Elephant Island almost most compelled them to eat all the

fresh meat that was needed for good health and there were no signs of scurvy. Consequently there was no frostbite and there were few other ailments.

#### Relief

Shackleton made rescue attempts in the *Endurance* Bay. The *Jeannette de Paris* found the *Endurance* before he was able to take his men off in the *Falke*. Knowing what their hardships had been, he flung packets of supplies ashore. The men were all embarked within an hour.

When they had been cramped on the ice, he and Wild had from time to time taken the ground to the men in their beds. Now on the passage to Punta Arenas he took more showed his leadership in the *Falke* although he could not stand Lenn, he took hard boiled eggs to Lenn in his hands, and gave his pillow to Tom Green who was sick. The party had been out of touch with the world for well over a year, and when Shackleton picked them up he remembered to bring newspapers for them to read. It was also unusual in their suffering that he had men to go with him again and again. In fact it seemed Lenn to stand him down as a character.

*The E. is thoughtful in providing newspapers. (September 3 AMM)*

It was fortunate that Shackleton was able to pick up his party on his fourth attempt. It had been thought they might have had to make a journey to Deception Island in the *Jeannette* with a hazardous undertaking for men in their condition.

Shackleton then went off to bring back the *Ross* but party who had been left in an even worse plight.

#### Summary

At one time it looked as if the *Endurance* expedition might be a complete disaster, for all the men returned home, nearly all of them to play a part in the Great War. The best thing that brought them safely through



## LETTERS TO THE EDITOR

Sir,

May we comment on the interesting article by J. G. Williams on parenteral nutrition (Vol. 84p 129-132).

It should be noted that the metabolic response to injury results in increased catabolism of resources as well as endogenous amino acids. There are a few points which might be worthy of further comment. In discussing caloric sources Dr Williams states that the energy required for the synthesis of protein can be supplied as fat or carbohydrate but neglects to mention the advantage of glucose which stimulates the secretion of insulin. Raised insulin levels will decrease acetoacids and protect protein synthesis from the amino acids thus spared. This will have a desirable amount of the unwanted amino acids literally going down the drain so to speak.

Secondly—the statement that fat requires carbohydrate is incorrect. Fat enters the Krebs cycle as the two carbon compound acetyl CoA as does pyruvate. The old concept of fat being burnt in a fire of carbohydrate is a myth as is the desirability of avoiding ketones. Most body tissues, including the brain, are well able to utilize ketone bodies as well as the ketone of starvation.

Finally there appears to be some doubt as to whether the organic phospholipid contained in Intralipid can be utilized as inorganic phosphate by the body so as to prevent hypophosphatemia which may result in permanent neurological changes.

It would be prudent to keep an eye open for this condition even though Intralipid is used.

Yours faithfully—

R. de G. Hansen      A. R. Foster  
Surgical Commander      Research Fellow

Sir,

Thank you for sending me a copy to your letter from Surgeon Commander Hansen and Dr Foster.

The effect of glucose upon insulin secretion depends upon the clinical situation. In the acute phase of stressful injury or illness insulin levels do not rise in response to a glucose load (Allison et al. 1967). Later insulin levels rise but endogenous is insufficient, probably due to high levels of organic components such as cortisol and adrenaline (Johnson et al. 1966) in both situations it may be necessary to give pharmacological doses of exogenous insulin to prevent hyperglycaemia but will be to promote protein synthesis (Hodges et al. 1971).

I agree that fat does not require carbohydrate to be oxidized completely. As stated in my article carbohydrate is necessary for fat to be used properly — i.e. in most tissues. Although this may be harmful to the starved but otherwise fit subject, and even to the chronically ill patient on long term parenteral nutrition with amino acids, Intralipid, and mineral carbohydrate (Gustavson et al. 1972) it remains unproven that ketosis is not harmful to the acutely stressed patient. In

this situation where health failure and/or resistance may be marked and other metabolic disturbances and hypoxia may may be present, analysis should be avoided!

Yours etc.,

J. G. Williams,

Surgeon Lieutenant Commander RN

ALLISON J P, PUGH R, CHAMBERLAIN M J (1975) Value of pulse oximetry in plasma level during ventilation and other myocardial situations. *Lancet* i, 1154-1155

ALLISON J P, BENTON P, CHAMBERLAIN M J (1975) Intensive plasma perfusion: studies and the first trial study in human patients. *Lancet* i, 1155-1156

BENTON P, ALLISON J P, LEVINGSON J, FLORES J (1975) Issues and plasma in volume controlled perfusion in acute infarcted patients. *Lancet* i, 1157-1158

CHAMBERLAIN M, BARTLETT A H (1976) J G (1975) Myocardial failure in patients receiving either low or high plasma flow (and, in some cases, nitrite). *Annals of Surgery* 184, 147-154

So

It is with some delight that I note that I made no mention of the Department for Naval Medicine at the Bernard Moore Institute for Human and Tropical Diseases at Harloway in my article in the Winter 1977 issue of the Journal (Turnbull, 1977).

One of the important sections of the Department is the compiling and linking of medical medical publications. In 1977 the Department for Naval Medicine published a bibliography of some 2,000 titles of these publications which are held in

the Department's library. I understand that in special circumstances photostat copies can be obtained on request.

Yours etc.,

T.A. Turnbull

Surgeon Commander RN Retd.

TURNBULL T. A (1977) Problems associated with Malaria and its therapeutic status in the United Kingdom. *J. Hyg. Camb. Camb.* 80, 161-174

So

I am extremely anxious for the Royal Naval Medical Service to be represented on the Submarine Museum at HMS Dolphin, and would be very happy to receive any documents relating to medicine in submarines. These of course could be copied and returned if required. I would particularly value any tools of the trade (gauges, etc. you prefer) and the more elderly and gruesome they are the better. Autopsies and medicine of an apparently ordinary nature would also contribute much to the display. Above all we need a last deliver dental drill.

Any help your modern one you will be very much appreciated.

Yours etc.

Richard Compton Hall

Commander HMS (Retd)

Curator

The Royal Navy Submarine Museum

HMS Dolphin, Gosport.

#### AUTHOR'S NOTE

ACCEPTED 1978: This copy of the *Handbook* (Department Series 200 00) received in the United Kingdom in 1977 is available to members of the European Conference on Medical History and members of the United Medical Society of a contemporary periodical.

# SERVICE NEWS

## IN MEDICAL AND DENTAL OFFICERS

### NEW YEAR'S PROMOTIONS

Commander of the Fleet Medical Center  
 Surgeon Captain P. C. Telford, DSO

Officer of the Order of the British Empire  
 Surgeon Commander R. E. Burt, DSO

### NEWBORN QUALIFICATIONS

Surgeon Commander (R.M.) J. Brown — MRCO  
 Perinatal Medicine

Surgeon Lieutenant Commander P. H. Brown —  
 MRCO

Surgeon Lieutenant Commander R. J. Allen —  
 MRCO

Surgeon Lieutenant Commander W. H. Burt —  
 MRCO

Surgeon Lieutenant Commander J. D. Burt —  
 MRCO

Surgeon Lieutenant R. A. Brown — FRCO (Edin)  
 Surgeon Lieutenant W. H. Brown — FRCO (Edin)

Surgeon Lieutenant R. A. Brown — FRCO (Edin)

### NEW ENTRIES

Surgeon Lieutenant Commander D. H. Cameron  
 Surgeon Lieutenant Commander D. H. Cameron

Surgeon Lieutenant D. H. Cameron  
 Surgeon Lieutenant D. H. Cameron

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Surgeon Lieutenant D. H. Cameron  
 Surgeon Lieutenant D. H. Cameron

## PROMOTIONS

### To Surgeon Vice Admiral

J. G. P. Brown, DSO, DFC and DFC (1955)

### To Surgeon Vice Admiral (Rtd) and Retired

J. H. Gifford, DSO, DFC and DFC (1955)



Surgeon Vice Admiral (Rtd) and Retired  
 J. H. Gifford, DSO, DFC and DFC (1955)  
 He was promoted to Surgeon Captain in 1955. In 1955 he visited the United States where he held an interview with the Secretary of the Navy. He was promoted to Surgeon Vice Admiral in 1955. He is currently Surgeon Vice Admiral (Rtd) and Retired.

### TRANSFERRED TO 4-YEAR COMMISSION

Surgeon Vice Lieutenant M. Burt, DSO, DFC and DFC (1955)  
 J. H. Gifford, DSO, DFC and DFC (1955)











## JAMES LIND MD PHYSICIAN TO HASLAR HOSPITAL 1750-1758



*In 1970, Lt. Admiral Sir James Mackenzie, KCB, MD, FRCS, FRCP, unveiled the portrait of James Lind which has been used to the Royal Naval Medical Service on Friday, February 17, 1971. The portrait is based on an engraving by Sir George Kneller, the original of which has been lost. It will hang in the Medical Store, RN Hospital, Haslar. The artist is Miss Sheila Dunning of Chichester. (See p. 104)*

## Editorial

*Mathematical theories in chess pattern  
are the specific details which form its  
subject — Aristotle*

Philosophy used to be the Queen of Sciences but like Physiology it is now a restricted discipline. The fundamental difference in approach between the theories of proteins and 'things' — however small the things — we can detect and measure — and our view of Nature are unrelated. We have been trained to think and accept in common sense that specific action produces a particular effect. But today none of our actions are so powerful that we are no longer aware of the secondary effects which even from us accompany the direct cause and effect relation. Our actions to produce specific measurable results can now have profound secondary effects on us and our habitat. These effects may be either understood immediately or long term rather than at our place of work, or widespread on our personal environment. Some may affect the society in which we live.

At the Institute of Naval Medicine we are concerned with these effects and their action on the efficiency of naval personnel. This involves their specialized training, their health and physical fitness, and a knowledge of the specialized environment in which they work and against their increasingly complex equipment. Many specialists are involved — clinicians, scientists, physiologists, psychologists, ergonomists, engineers — and in the Navy uniformed medical officers are essential to this team. The addition of scientifically trained Medical Service officers is desirable in the INM model — in the action which comprises in 1979 — we will establish a Physiological Laboratory to meet in the management of these problems and provide

within this in the promotion of health and physical fitness, within the constraints of the limited resources in which we must operate.

The National Health Service has not made its conception pursued the promotion of positive health. It has extended the distribution and availability of various services for disease or injury whether as primary care and care or as secondary investigation and treatment, on the basis that early diagnosis and effective treatment will have the effects of disease on the individual and palliate the effects on society of the ineffective sick and injured. Its present preoccupation is with the reducing costs of hospital investigation and treatment but it has been successful — despite previously increased waiting times for admission to hospital — in achieving a more even distribution of medical care throughout the country.

The Naval Medical Service faces the same problems: more acute since it is small, and has so many specialized requirements. The Ministry of Defence must equip the advanced patients and staff and the cost of equipment and staff runs out of the Defence Vote, is particularly concerned with its hospitals and their effective use and in particular with early admission and rapid return to effective full duty of patients. Clearly with expensive naval personnel it is even more true today than there can be making more wasteful than having men on the sick list, not able properly to perform their duty.<sup>1</sup>

Because of the cost and complications of modern hospital treatment, nearly today seeks to limit the demands for treatment in hospital and avoidance of some advances may be possible. The fit and healthy may

not get degenerative disease and should recover more quickly from injury and sickness. Today the growing areas of medicine are in primary and preventive care, general practice and occupational medicine. New hazards at the work place have made development of the latter essential. The new statutory regulations<sup>1</sup> will apply to the Armed Services and we are regarding the Occupational Hygiene service provided from INM improvements in these areas may limit hospital admissions but will not abate the requirement as the Navy has early hospital admission, unless longer absence than duty for illness and injury are accepted.

Earlier this year the Faculty of Occupational Medicine was established. Last year's winter proposals were approved to reorganise the neglected non-hospital disciplines in the Naval Medical Service into a composite Occupational Medicine group which will comprise Industrial Medicine in the Naval Base Aviation Medicine, Submarine Medicine, Boatswain Medicine, Survival Medicine, Underwater Medicine, Reproductive Human Factors, and the supportive research discipline of Physiology. This novel spectrum of Occupational Medicine must clearly be added to the Civil Faculty and the problems of accreditation for naval medical officers' post experience and issues scheduled training for such accreditations are being examined with the Specialist Advisory Committee of the new Faculty. Similarly the problems of accredited training in General Practice is being pursued. It is hoped that the training requirements in both these areas of medical practice will be organised on a similar basis to that which already exists in the disciplines of specialist clinical medicine in hospital practice. Although the balance between types of practice may change more effectively to meet naval needs the proposed improvements in the non-hospital disciplines must not deprior-

itise the established standards in the hospital disciplines and equivalent naval careers should be available in all three major sub-divisions of naval medical practice.

To meet the developing needs in occupational medicine and general practice we need a new breed of general duties medical officer recruited like these predecessors to the Naval Service but professionally competent in the new disciplines and with accredited training equivalent to those below medical without in hospital practice.

We are all aware of the imbalance in naval medical and para medical personnel between those within hospitals and those without and there has been a swing — some would say a too rapid swing — in an attempt to redress this imbalance. We must provide satisfying professional jobs in the neglected non-hospital fields of occupational medicine and general practice to meet the needs of the Service in these vast areas. For no these problems are there for the optimistic and realistic thinking for the 1980's which is the essential for the future as the First Sea Lord emphasised in his message in February 1970.<sup>2</sup>

Being aware of these basic difficulties facing our future we know they cannot be met unless we solve the problems of recruitment and retention. Both can be achieved by proper jobs with proper rewards for the satisfying professional task of meeting the Navy's needs now and in the future.

Our conditions of service and types of commitment need a basic review to meet the present and the future needs of the Navy.

You cannot bring about prosperity by discouraging slack; you cannot encourage the work by weakening the strong; and you cannot help the poor by depriving the rich. — *Lincoln*

<sup>1</sup> *From Our Thoughts*, C 11, Washington Technical 1971.

<sup>2</sup> *Admiral Sir John Jellicoe*, letter, 1970.

<sup>3</sup> *The Independent*, Friday 24 March, 1970.

<sup>4</sup> *Admiral Sir Thomas Lyster*, Memorandum 1971.

1. **Information:** The information provided in the document is accurate and reliable.

**Abstract** The purpose of this study was to determine whether there were differences in the prevalence of self-reported depression between men and women who had been exposed to violence by intimate partners. Data from the National Longitudinal Study of Women's Health are used. Results show that among those who have ever been married or cohabited, 6% of men and 8% of women reported having experienced depression during their lifetime. Among those who had never been married or cohabited, 7% of men and 9% of women reported having experienced depression during their lifetime. These results suggest that exposure to violence by intimate partners may increase the risk of depression.

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[illegible]

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The Royal Navy provides these islands with the mobile base and for their security and ships of every type must be capable of remaining at sea for extended periods. Amongst others two factors which limit the cruising range of a ship are the food supplies it can carry and the endurance of the crew. The second factor can be determined largely by the first, that is by the quality of the food stored and the amount of time it takes to eat.

Throughout history man has sought supplies of food and water which would provide adequate nutrition and keep easily stored during the hard degree and number of undesirable effects. Only during the last century has this search been restricted to water-soluble forms, because improved food and water was the needed goal. It is only in the past 50 years that

analytical and biological techniques have enabled the basis of evidence to be established well defined (Crombag, 1997).

Many diseases have a significant impact but the ten million have recognized either the food produced and/or the immediate signs of distress (McCauley and Feldman, 1988). This article constitutes a review of the subjects that are a direct result of disease.

In the small, isolated, closed community that is a ship company, motivation and discipline enhanced importance to the leader's duty is so much an inseparable feature of his environment as is the atmosphere of brotherhood and the nature of the shipboard life is such that immediate participation with what they can has always been greater than that of landmen. Research leads to such increasing enhanced social importance to the leader's daily routine and more precisely there are the topical problems of understanding of men. Moreover, man-machine-induced documents of performance can have deleterious effects upon the safety of the ship and her crew both as a vehicle and as a fighting machine. In Robinson's terms, maintenance for the keels of warred together with democracy and such diseases as typhoid and tuberculosis killed ten times as many men as fell in action (May 1944). This document by disease increased the difficulty in mounting the Fleet, thus started the long tradition of naval medical advancement in the fields of infection, diet and health.

### Fluorid

The era of our ancestors' (Miles Thompson 1974) which lasted until the end of the 18th century was opened by the long sea voyages made possible by improvements in navigation and ship design. This era was established through the acceptance of nutritional principles, notably in particular Scotland's by means other than salt drying and pickling and corruption and administrative incompetence (Jord 1967). Ministers of the time were at last conservative: thus, their modern counterparts' toughness was the dominant force and they continued to ignore warmth and a liberal diet (Jord 1977). Death, disease and accident constituted efficient natural selection. The British at Sea was a superb fighting machine by its attention to self-discipline.

But in the King's ships changed little during this period. The official recording scales (Fig 1) show that the 18th century seaman was better fed than his land-based contemporary who rarely ate meat. The average sailor was approximately 20-MJ over the deduction of the porter's rights and certainly met energy requirements — today's middle class live between 12 and 14 MJ daily (Southgate and Klasing 1970; Milburn, Chandra and Sedlitz 1974) — but had no nutritional shortcomings. In addition the house was usually heated with wood, the meat pot on the hearth and the chimney draft is said to have been sufficient for business. It is not surprising that it was among isolated men that scurvy became the common and dreaded disease. 'Its ravages' were truly terrible (Cook, 1783). That they are down to a close at the end of the 18th century was in the main through the efforts of medical officers of the Royal Navy, among whom James Lind remains the figure. Lind made the single greatest contribution in that at any age in the health and well-being of seamen by

BISCUIT	1 lb per day
BEEF	1 gallon per day
PORK	2 lb per week
SALT BEEF	4 lb per week
BREAD GRAIN	2 plots per week
BUTTER	3½ lb per week
EGGS	1 lb per week
DRYED FISH	5 oz per week

### THE FORTY QUANTITY FOR PURCHASER ALLOWANCE APPROXIMATE (HUNT 1961) (DAILY PER GUY)

Fig 1. Eighteenth century rations compared — based on the official recording scale circa 1780 from Lloyd (1964). Scavenging, rather than to remove material for medical help (Cook).

establishing beyond all doubt that scurvy could be quickly and effectively cured and easily prevented (Jord 1973). The absorption of the effect of the application of Lind's discovery principles on the preservation of sailors has been matched once only — but on a smaller scale — by the death of Malta from the Mediterranean (Duffy, 1953). When in 1956 the Lords of the Admiralty, as a rare burst of wisdom, prohibited further consumption of ports with undiluted lemon — which for half a century had dominated the Fleet, introduced at Malta — would within a year. A rare example of executive decision based on medical advice, it was Effective.

### Modern Day and Contemporary Diseases

Tremulous to modern diseases in the Fleet was also the first comprehensive scale in the use of portable soap (once correct) and lemon juice being due to the insistence of the medical department. Concept of

meat was followed in 1913 by the introduction of canned meat and vegetables, but because of cost it was not until 1947 that canned food became part of the military rations, and (May and Gaster 1948). Thirty years later the advent of refrigeration brought problems with food preservation to its end. In the nineteen twenties general messing was introduced with the main planned and cooked centrally, responsibility for the individual's diet became that of the Supply Officer, who knew more of dietetics than did the soldiers. Since the last war collective messing has been introduced and subsequently has become general throughout the Fleet. A contemporary menu from HMS *Beard* (Fig. 2) shows that collective messing offers

a considerable choice of high quality food. A typical Western diet, palatability and variety compare favourably with continental food anywhere (Fig. 3). There



Fig. 2. I was on the cook — a Chef Petty Officer aboard HMS *Beard* in 1978.

DINNER	
BATH POB SUP	
TOMATO SUP	
BOLLO-CHICKEN AND TOMPLING	
CHICKEN MUTTON AND RICE	
POMPOUSHANE SOUP RICE	
CHICKEN PASTES	
BREAD BUTTER & BUT	
FRIED CHICKEN	
FISH STEAK AND BAKING	
CUSTARD PU	
COLD LAMB PORK, BEEF CHICKEN BEEF	
BROTHS IN TOMATO SAUCE	
SALAD SELECTION	
BREAD CRUMBS, CHICKEN, PASTRY POLAROID	
BREAD CABBAGE, TART, CHICKEN CABBAGE	
HARDWEAR PORK, BAKED BEANS	
BEEF BROWN GRavy, SAUER TARTAR	
BAKING, TART	
ICE CREAM	
JULIAN FRUIT COOKING	
CUSTARD	
FRESH FRUIT	
CHERRY AND BROSURE	

Fig. 3. Cheapest, rare and dry food — several years ago. It was dry, and dry, and dry. (May 1978) HMS *Beard* in a 1978 was quoted as being with a complement of 130. (Estimated by means of Captain A. J. 1978).

is little doubt that this is what sailors want, but as has been stated by Milton Thompson (1974) there are two crucial points to be made. Firstly, the choice has now returned to the individual who can select from this impressive menu either the most deliciously available or deliciously considerable combination, no longer run the Supply Officer, with his knowledge of dietetics, guide the eating habits of the sailor. Secondly, the freedom of choice has occurred when diets have been raised as to whether modern Western diet is nutritious enough.

Over the last 150 years or so the diet not only of sailors but of the population of the United Kingdom and of other Western countries has changed. The proportion of calories derived from fat has risen and that from carbohydrate has fallen, and within

the carbohydrate element there has been a marked shift from unrefined carbohydrates and starch to refined sugar (Hollingsworth and Gowers, 1967). In the last few decades food technology and changes in farming practice have produced other modifications in our food, the nutritional effects of which are not fully known. During this period there has been a change in the pattern of disease, particularly over the past 50 years. During this time our mode of life and our environment have altered in many other respects, and the question arises to what extent is the increased incidence of the so-called diseases of civilization caused by changes in the diet. Few surveys would now dispute that Western man eats too much meat, too much animal fat and dairy product, too much refined carbohydrates and too little dietary fibre. The possible relation of Western diet to Western diseases has been the subject in the last 20 years of more than 500 articles and 12 books. H. C. Trowell (1977a) has defined the diseases of Westernization as having the following characteristics:

Distribution strongly limited to the Western hemisphere and Auro zones.

Aetiology unknown.

Incidence increases past puberty with Westernization of diet and lifestyle.

It was in 1956 that T. L. Clave, then a serving naval medical officer, first mentioned dietary refined carbohydrates as the basic cause of many modern degenerative diseases of Westernized countries (Clave, 1956). He advanced the dietary concept of a refined carbohydrate disease, which he later called saccharine dysmetabolism (Clave, 1962, 1977), ascribed to a single dietary error — the refining of carbohydrates. His original paper described the use of consumption of refined sugar in the United Kingdom from 7 kg per head per year in 1885 to more than 25 kg in

1956. (The opposite trend continues. Waple (1977) gives the latest figure as 21 kg per head per year). To overconsumption of refined carbohydrates Clave attributed obesity, diabetes and coronary thrombosis, to the removal of dietary fibre, degenerative disease and varicose veins, and to the removal of protein, peptic ulcer. Clave later published monographs on coronary disease, varicose veins and peptic ulcer (Clave, 1957, 1968, 1962) and carried the concept further forward in a joint work (Clave, Campbell and Punter, 1968). In the final elaboration of his concept Clave (1974) arrived again by concluding that the causation of the manifestations of saccharine disease had been observed through maladjusted decreases being drawn between consumption of refined and unrefined carbohydrates. It was the overconsumption of refined carbohydrates, especially of sugar, and not that of all carbohydrates, which was linked to the causation of disease.

Today the average Briton obtains 60 per cent of his daily food energy from three types and from where three that contain only a third of its original fibre. A growing body of opinion is in some agreement with Clave's views on the cause over consumption of the Western diet (Kosken, 1972; Trowel, 1972, 1977a; Barlett and James, 1973; Punter, 1975; Barlett and Walker, 1976) and two recent studies have implicated dietary intake of refined carbohydrates in the aetiology of Cushing's disease (Blanton and Brander, 1976; James, 1977). On the other hand, much of the evidence is spurious, piecemeal, and inferential and the work of Clave and his successors has been described as being but a skilful blend of circumstantialities, a plausible story embellished with random measurements and little scientific evidence. Personal work is mentioned, but appears deficient, but this does not detract from the concept.



The problem of identifying causal relationships with food is compounded by two factors. Firstly, the ontology of many of these diseases is chaotic, certainly multifactorial, and the underlying mechanisms obscure. Secondly, present methods of describing chronically the catabolism of food are unsatisfactory. Contemporary food intake (McCance and Widdowson, 1960) are based on a division of the carbohydrate into available and non available fractions. Available carbohydrate was originally defined and measured directly as the sum of simple sugar and starch. A more precise definition is desirable for several reasons. There are differences between sugars in their metabolism and biological effects as exemplified by glucose tolerance; by the differences between the effects of maltose and sucrose on glucose tolerance and by the differential effect of sucrose or fructose on serum triglycerides as compared with glucose and maltose. The effects of dextran compared with amylose and amylopectins on the gastric mucosal flora and the effects of differently structured saccharides on digestion and on faecal bulk require defining. The true flow control of most foods in children and even adults' lives, used as the majority of human experiments is unstandardized, so that it is impossible to compare one set of results with another to explain the remarkable way by which lean diets but toxic diets cause some and sometimes death rates.

Notwithstanding the problems, by overconsumption or varying proportions overconsumption of concentrate (energy (as sugar and starch) and depletion of fibre (as refined carbohydrate foods) to explain the occurrence of different diseases. Clever has developed a concept of potential significance; his logic is hard to refute and his work has in part been vindicated by the recent upsurge of interest in dietary fibre (Hoar, Potvin and Horton, 1971;

Heaton 1971; Parks, 1971; Armstrong 1971; 1976; Jones and Cummings 1974; Kawan et al. 1974; Smith et al. 1974; Englebrg and Humphrey 1976; Kawan and Smith 1977). Cummings (1973) found more than 300 references on dietary fibre. It is of interest that a wife Clever (1941) who introduced supervised diets into therapeutics more than 40 years ago.

Overconsumption of food is a major cause of ill health afflicting Western man (McLaren 1951; Clever 1977) and obesity has been recognized as the commonest form of malnutrition in our society (Anderson, 1972). By the conservative definition of obesity as being more than 10 per cent over ideal weight (Orthopaedic Life Insurance Company 1959) had the adult population of England in 1966 (Silverman 1965; Monograph 1971) and more than 90 per cent of Scottish students were more fat than the physiological optimum (Dwyer 1971). Severe, apparently, are no exceptions. It is to be expected that changes in eating and drinking habits should be reflected in up-bought weight relationships and, in a survey of 10 000 males, Mackay (1976) showed that the contemporary trend along a 7 kg heavier than his predecessor of 1950 matched for age and height. It is possible that accelerated growth in adolescence due to increased feeding of children may have contributed to this weight increase among the younger cohorts but on the other hand the weight-for-height difference is maintained until the age of 35. In reporting similar findings from a civilian population, Rhoads and Lova (1964) concluded that cohorts of increasingly obese young men were moving into the adult population and Mackay's figures are likely to represent a true increase in the fatness of adults. Until there is established an agreed diagnostic criterion for obesity, be it relative weight (Dyer et al. 1974), some form of weight-height index (Goldman and Medina,

1974) body symmetry as employed in the Royal Canadian and the United States Navies (Roberts *et al.* 1952) or measurement of skeletal thickness (Dorton and Hahamian 1967). Dorton and Wainman (1974) (1) is extremely difficult to assess the prevalence of this condition objectively. Subjectively on the other hand, there is growing concern in the Navy at what is seen to be the narrowed peak of the modern sailor. It is clear that very little is understood about the control of energy balance and without this understanding analysis of the factors contributing to obesity must be superficial. However, ready to label obese sailors as examples of 'self destruction before us' (Jennison, 1970) is unhelpful.

In a series of publications Barlett (Dorton and Tansell, 1975) suggest that deteriorating stream and control of the colon are related to the recent time of the universal contract; a factor largely influenced by diet (Foulds *et al.* 1976). In this report naval ratings have as their a factor time as any other group and may therefore be particularly prone to these conditions as first the (Majors-Thompson, 1974). There is no evidence on this point for navy 50 per cent of the naval population is below the age of 25, is there Navy is to be used the problem posed by the removal of modesty and modesty standard concerning sailors who have passed outside the sphere of influence of the Navy Medical Department has been solved (Thom, 1972). Wain (1972) suggested that the incidence of peptic ulcer in the Navy is more than three times that in a comparable National Health Service male population. Factors believed to account for this disparity were the emotional personality of those recruited in the seagoing life, operational conditions associated with responsibility and manpower shortages, lack of exercise and a diet rich in animal carbohydrates. Wain pointed out that the incidence of

peptic ulcer in the Navy was rising while that in the civilian population was falling, and that this was corresponded to the change over to carbon's burning and profit share meals together with improvement in the status and raising of moral standards resulting in very high standards of eating (Fig. 4). He also quoted Forrest as showing that the consumption of confectionery in ships is three times the national average. Wain concluded that 'in view of the evidence of high consumption of refined carbohydrates in the Royal Navy it would be difficult to reach the conclusion that there is a direct relationship between diet, obesity and the high incidence of peptic ulceration' (Wain 1972). It was, of course, one of Cairns' early comments (Cairns 1956-1962) that removal of protein by reducing carbohydrates reduces fueling power, so allowing unbalanced expenditure and to cause the breakdown.

#### NAVAL AND CIVILIAN PEPTIC ULCER INCIDENCE

NOTE: INCIDENCE OF PEPTIC ULCER IN THE ROYAL NAVY AND IN THE CIVILIAN POPULATION

1. ALL PEPTIC ULCER PATIENTS FOR THE PERIOD 1960-1969

Peptic Ulcer Incidence (per 1000)			
Year	Age	Sex	Rate
Royal Navy			
1960-1969	15-24	Male	1.0
1960-1969	25-34	Male	1.0
1960-1969	35-44	Male	1.0
1960-1969	45-54	Male	1.0
1960-1969	55-64	Male	1.0
1960-1969	65-74	Male	1.0
1960-1969	75-84	Male	1.0
1960-1969	85-94	Male	1.0
1960-1969	95-104	Male	1.0
1960-1969	105-114	Male	1.0
1960-1969	115-124	Male	1.0
1960-1969	125-134	Male	1.0
1960-1969	135-144	Male	1.0
1960-1969	145-154	Male	1.0
1960-1969	155-164	Male	1.0
1960-1969	165-174	Male	1.0
1960-1969	175-184	Male	1.0
1960-1969	185-194	Male	1.0
1960-1969	195-204	Male	1.0
1960-1969	205-214	Male	1.0
1960-1969	215-224	Male	1.0
1960-1969	225-234	Male	1.0
1960-1969	235-244	Male	1.0
1960-1969	245-254	Male	1.0
1960-1969	255-264	Male	1.0
1960-1969	265-274	Male	1.0
1960-1969	275-284	Male	1.0
1960-1969	285-294	Male	1.0
1960-1969	295-304	Male	1.0
1960-1969	305-314	Male	1.0
1960-1969	315-324	Male	1.0
1960-1969	325-334	Male	1.0
1960-1969	335-344	Male	1.0
1960-1969	345-354	Male	1.0
1960-1969	355-364	Male	1.0
1960-1969	365-374	Male	1.0
1960-1969	375-384	Male	1.0
1960-1969	385-394	Male	1.0
1960-1969	395-404	Male	1.0
1960-1969	405-414	Male	1.0
1960-1969	415-424	Male	1.0
1960-1969	425-434	Male	1.0
1960-1969	435-444	Male	1.0
1960-1969	445-454	Male	1.0
1960-1969	455-464	Male	1.0
1960-1969	465-474	Male	1.0
1960-1969	475-484	Male	1.0
1960-1969	485-494	Male	1.0
1960-1969	495-504	Male	1.0
1960-1969	505-514	Male	1.0
1960-1969	515-524	Male	1.0
1960-1969	525-534	Male	1.0
1960-1969	535-544	Male	1.0
1960-1969	545-554	Male	1.0
1960-1969	555-564	Male	1.0
1960-1969	565-574	Male	1.0
1960-1969	575-584	Male	1.0
1960-1969	585-594	Male	1.0
1960-1969	595-604	Male	1.0
1960-1969	605-614	Male	1.0
1960-1969	615-624	Male	1.0
1960-1969	625-634	Male	1.0
1960-1969	635-644	Male	1.0
1960-1969	645-654	Male	1.0
1960-1969	655-664	Male	1.0
1960-1969	665-674	Male	1.0
1960-1969	675-684	Male	1.0
1960-1969	685-694	Male	1.0
1960-1969	695-704	Male	1.0
1960-1969	705-714	Male	1.0
1960-1969	715-724	Male	1.0
1960-1969	725-734	Male	1.0
1960-1969	735-744	Male	1.0
1960-1969	745-754	Male	1.0
1960-1969	755-764	Male	1.0
1960-1969	765-774	Male	1.0
1960-1969	775-784	Male	1.0
1960-1969	785-794	Male	1.0
1960-1969	795-804	Male	1.0
1960-1969	805-814	Male	1.0
1960-1969	815-824	Male	1.0
1960-1969	825-834	Male	1.0
1960-1969	835-844	Male	1.0
1960-1969	845-854	Male	1.0
1960-1969	855-864	Male	1.0
1960-1969	865-874	Male	1.0
1960-1969	875-884	Male	1.0
1960-1969	885-894	Male	1.0
1960-1969	895-904	Male	1.0
1960-1969	905-914	Male	1.0
1960-1969	915-924	Male	1.0
1960-1969	925-934	Male	1.0
1960-1969	935-944	Male	1.0
1960-1969	945-954	Male	1.0
1960-1969	955-964	Male	1.0
1960-1969	965-974	Male	1.0
1960-1969	975-984	Male	1.0
1960-1969	985-994	Male	1.0
1960-1969	995-1004	Male	1.0
1960-1969	1005-1014	Male	1.0
1960-1969	1015-1024	Male	1.0
1960-1969	1025-1034	Male	1.0
1960-1969	1035-1044	Male	1.0
1960-1969	1045-1054	Male	1.0
1960-1969	1055-1064	Male	1.0
1960-1969	1065-1074	Male	1.0
1960-1969	1075-1084	Male	1.0
1960-1969	1085-1094	Male	1.0
1960-1969	1095-1104	Male	1.0
1960-1969	1105-1114	Male	1.0
1960-1969	1115-1124	Male	1.0
1960-1969	1125-1134	Male	1.0
1960-1969	1135-1144	Male	1.0
1960-1969	1145-1154	Male	1.0
1960-1969	1155-1164	Male	1.0
1960-1969	1165-1174	Male	1.0
1960-1969	1175-1184	Male	1.0
1960-1969	1185-1194	Male	1.0
1960-1969	1195-1204	Male	1.0
1960-1969	1205-1214	Male	1.0
1960-1969	1215-1224	Male	1.0
1960-1969	1225-1234	Male	1.0
1960-1969	1235-1244	Male	1.0
1960-1969	1245-1254	Male	1.0
1960-1969	1255-1264	Male	1.0
1960-1969	1265-1274	Male	1.0
1960-1969	1275-1284	Male	1.0
1960-1969	1285-1294	Male	1.0
1960-1969	1295-1304	Male	1.0
1960-1969	1305-1314	Male	1.0
1960-1969	1315-1324	Male	1.0
1960-1969	1325-1334	Male	1.0
1960-1969	1335-1344	Male	1.0
1960-1969	1345-1354	Male	1.0
1960-1969	1355-1364	Male	1.0
1960-1969	1365-1374	Male	1.0
1960-1969	1375-1384	Male	1.0
1960-1969	1385-1394	Male	1.0
1960-1969	1395-1404	Male	1.0
1960-1969	1405-1414	Male	1.0
1960-1969	1415-1424	Male	1.0
1960-1969	1425-1434	Male	1.0
1960-1969	1435-1444	Male	1.0
1960-1969	1445-1454	Male	1.0
1960-1969	1455-1464	Male	1.0
1960-1969	1465-1474	Male	1.0
1960-1969	1475-1484	Male	1.0
1960-1969	1485-1494	Male	1.0
1960-1969	1495-1504	Male	1.0
1960-1969	1505-1514	Male	1.0
1960-1969	1515-1524	Male	1.0
1960-1969	1525-1534	Male	1.0
1960-1969	1535-1544	Male	1.0
1960-1969	1545-1554	Male	1.0
1960-1969	1555-1564	Male	1.0
1960-1969	1565-1574	Male	1.0
1960-1969	1575-1584	Male	1.0
1960-1969	1585-1594	Male	1.0
1960-1969	1595-1604	Male	1.0
1960-1969	1605-1614	Male	1.0
1960-1969	1615-1624	Male	1.0
1960-1969	1625-1634	Male	1.0
1960-1969	1635-1644	Male	1.0
1960-1969	1645-1654	Male	1.0
1960-1969	1655-1664	Male	1.0
1960-1969	1665-1674	Male	1.0
1960-1969	1675-1684	Male	1.0
1960-1969	1685-1694	Male	1.0
1960-1969	1695-1704	Male	1.0
1960-1969	1705-1714	Male	1.0
1960-1969	1715-1724	Male	1.0
1960-1969	1725-1734	Male	1.0
1960-1969	1735-1744	Male	1.0
1960-1969	1745-1754	Male	1.0
1960-1969	1755-1764	Male	1.0
1960-1969	1765-1774	Male	1.0
1960-1969	1775-1784	Male	1.0
1960-1969	1785-1794	Male	1.0
1960-1969	1795-1804	Male	1.0
1960-1969	1805-1814	Male	1.0
1960-1969	1815-1824	Male	1.0
1960-1969	1825-1834	Male	1.0
1960-1969	1835-1844	Male	1.0
1960-1969	1845-1854	Male	1.0
1960-1969	1855-1864	Male	1.0
1960-1969	1865-1874	Male	1.0
1960-1969	1875-1884	Male	1.0
1960-1969	1885-1894	Male	1.0
1960-1969	1895-1904	Male	1.0
1960-1969	1905-1914	Male	1.0
1960-1969	1915-1924	Male	1.0
1960-1969	1925-1934	Male	1.0
1960-1969	1935-1944	Male	1.0
1960-1969	1945-1954	Male	1.0
1960-1969	1955-1964	Male	1.0
1960-1969	1965-1974	Male	1.0
1960-1969	1975-1984	Male	1.0
1960-1969	1985-1994	Male	1.0
1960-1969	1995-2004	Male	1.0
1960-1969	2005-2014	Male	1.0
1960-1969	2015-2024	Male	1.0
1960-1969	2025-2034	Male	1.0
1960-1969	2035-2044	Male	1.0
1960-1969	2045-2054	Male	1.0
1960-1969	2055-2064	Male	1.0
1960-1969	2065-2074	Male	1.0
1960-1969	2075-2084	Male	1.0
1960-1969	2085-2094	Male	1.0
1960-1969	2095-2104	Male	1.0
1960-1969	2105-2114	Male	1.0
1960-1969	2115-2124	Male	1.0
1960-1969	2125-2134	Male	1.0
1960-1969	2135-2144	Male	1.0
1960-1969	2145-2154	Male	1.0
1960-1969	2155-2164	Male	1.0
1960-1969	2165-2174	Male	1.0
1960-1969	2175-2184	Male	1.0
1960-1969	2185-2194	Male	1.0
1960-1969	2195-2204	Male	1.0
1960-1969	2205-2214	Male	1.0
1960-1969	2215-2224	Male	1.0
1960-1969	2225-2234	Male	1.0
1960-1969	2235-2244	Male	1.0
1960-1969	2245-2254	Male	1.0
1960-1969	2255-2264	Male	1.0
1960-1969	2265-2274	Male	1.0
1960-1969	2275-2284	Male	1.0
1960-1969	2285-2294	Male	1.0
1960-1969	2295-2304	Male	1.0
1960-1969	2305-2314	Male	1.0
1960-1969	2315-2324	Male	1.0
1960-1969	2325-2334	Male	1.0
1960-1969	2335-2344	Male	1.0
1960-1969	2345-2354	Male	1.0
1960-1969	2355-2364	Male	1.0
1960-1969	2365-2374	Male	1.0
1960-1969	2375-2384	Male	1.0
1960-1969	2385-2394	Male	1.0
1960-1969	2395-2404	Male	1.0
1960-1969	2405-2414	Male	1.0
1960-1969	2415-2424	Male	1.0
1960-1969	2425-2434	Male	1.0
1960-1969	2435-2444	Male	1.0
1960-1969	2445-2454	Male	1.0
1960-1969	2455-2464	Male	1.0
1960-1969	2465-2474	Male	1.0
1960-1969	2475-2484	Male	1.0
1960-1969	2485-2494	Male	1.0
1960-1969	2495-2504	Male	1.0
1960-1969	2505-2514	Male	1.0
1960-1969	2515-2524	Male	1.0
1960-1969	2525-2534	Male	1.0
1960-1969	2535-2544	Male	1.0
1960-1969	2545-2554	Male	1.0
1960-1969	2555-2564	Male	1.0
1960-1969	2565-2574	Male	1.0
1960-1969	2575-2584	Male	1.0
1960-1969	2585-2594	Male	1.0
1960-1969	2595-2604	Male	1.0
1960-1969	2605-2614	Male	1.0
1960-1969	2615-2624	Male	1.0
1960-1969	2625-2634	Male	1.0
1960-1969	2635-2644	Male	1.0
1960-1969	2645-2654	Male	1.0
1960-1969	2655-2664	Male	1.0
1960-1969	2665-2674	Male	1.0
1960-1969	2675-2684	Male	1.0
1960-1969	2685-2694	Male	1.0
1960-1969	2695-2704	Male	1.0
1960-1969	2705-2714	Male	1.0
1960-1969	2715-2724	Male	1.0
1960-1969	2725-2734	Male	1.0
1960-1969			

Critically there is evidence that the normal intake of refined carbohydrates by sailors is high. Mean daily intake of sucrose and glucose by nine young sailors on a five day study confined in a metabolic chamber varied between 250 g and 400 g on a 75 day study (Bishop and Morris, unpublished) and individuals consumed as much as 800 g on some days. Wardle (1977) quotes the equivalent United Kingdom national average consumption as 155 g — a figure based, of course, upon the total population. Consumption of one type of sugar rich beverage — the softensated soft drink — has recently increased significantly throughout the Navy (Morris *et al.* 1978) ships have been fitted with automatic dispensers providing drinks made from concentrated syrups and it is known that, not uncommonly, the quantity dispensed — 200 ml — is divided in 'teen sales' and for the same reason additional sugar is added when mixing up the drinks from the manufacturers' concentrates. It is of interest in this context that Gupta, Basaria and Chhabra (1974) showed that when carbohydrate was given in the form of a drink, plasma glucose responses were 40 ml per cent higher than when the same carbohydrate was given as a meal.

One of the most pressing shipboard problems is the limited storage space for food. The advent of nuclear propulsion and increasing advances in weapons and electronic equipment have maintained this problem — storage space is needed for military purposes at the very time that increased crewing, range demands embarking of more food. The only alternative to providing more storage space is to provide greater mass density — to put more food in the same space by taking advantage of food technology. Concentrated, dehydrated, preblended, compressed, pre-cooked and frozen foods are among those foods the most important characteristics of which is their

concentration. In nuclear submarines — with their design ranging from 33 weeks or more — storage and consumption are occupational hazards (Thom, 1973) and of Course (1964) and Yachon (1965) are to be believed there are the inevitable consequences of food concentration and of separating palatability from nutritional value. Boredom leads to eating something rather important, and nothing will prevent the sailor from filling up at each meal. Southgate and Stirling (1964, 1969) surveyed the diet of submariners and concluded that the energy derived from the food exceeded the average energy expenditure by an amount that was statistically significant. In the particular context of obesity in submariners it is noteworthy that Edmondson (1970) demonstrated that maximum tolerance decreased by a measure 27 per cent in the course of a six week period.

In a survey of weightlifters in the Royal Navy, Blacklock (1965) found the highest incidence of meal plete to be amongst officers, cooks and supply personnel and the lowest incidence amongst Royal Marines and seamen. He considered the distribution to be related to physical activity, the incidence of weightlifters being highest in voluntary groups and lowest in select groups. Blacklock did not at that time directly implicate the sailor's diet as an aetiological factor but important features that he found over an incidence of proven peptic ulcer of seven per cent among the active seamen — 20 times the incidence of peptic ulcer in the Navy as a whole — and over 200 of his 524 cases were overweight compared to a control group which showed a much greater conformity with the average (Blacklock 1965). The positive correlation between body weight and upper urinary tract calcification was confirmed in certain camps in Leeds (Hobson *et al.* 1979) and Sydney (Garrow, Stroh and Pocock 1970) unfortunately body height was not





## A Five Year Study of Surgical Wound Infection

R. T. Jones and T. W. McCarthy

### ABSTRACT

*A five year prospective survey of surgical wound infection was carried out at the Royal Naval Hospital, Haslar from January, 1972 to December 1976. There are 40 surgical wards with a total of 2,000 patient beds on site (1,123 when a wing is extended). Following an epidemic in the operating theatre's ventilation system, the infection rate fell from 3.7% per case to below 1.0% per case. The incidence of the various infecting organisms and the changes in antibiotic sensitivity of pathogens in wound infection are recorded and the incidence of infection on the different surgical specialties is noted. Further cases on surgical sepsis are discussed.*

### Introduction

Wound infection remains a hazard of surgery. In order to study its incidence and the circumstances of its occurrence a five year prospective survey was carried out at the Royal Naval Hospital, Haslar from January 1972 to December 1976.

### Material

The Royal Naval Hospital, Haslar is an acute general hospital with 400 beds. Its functions include providing an accident and emergency service for the surrounding locality. About half its patients are servicemen and the remainder are from the local civilian population. The range of work carried out is that of an average district general hospital with the exception that there is no maternity.

The building dates from 1756, but it has been progressively modernized over the years. At present about one third of the beds are in recently modernized four or six bedded wards and the remainder in open Nightingale type wards. The operating theatre accommodation consists of a pair of large theatres with filtered air plasma

ventilation and a smaller single theatre without artificial ventilation. Which is used for ENT, dental and repair cases. During the period under review a total of 13,123 clean open operations were done.

### Method

A monthly record was kept of the total number of cases passing through the operating theatres, the open operations carried out through incision alone and not through body orifice were extracted from the total, and from these the number of those not at risk operations was recorded.

The Sisters of all surgical wards kept a weekly record of patients admitted with sepsis or who subsequently developed sepsis.

The Infection Control Nursing Officer who started all the wards several times a week collected these records and collected them with the bacteriological reports on all wound swabs taken during the month. The double-check system ensured that sepsis cases did not go unrecorded.

From these returns a monthly sepsis report was compiled. Sepsis operation cases were categorized as follows:

- 1 Those exposed with sepsis before delivery of the operation. These included cases in which sepsis was present throughout the time in the case of operations done at which a prosthetic or in body cavity such as the colon was opened and those with compound fractures.
- 2 Those in which there was a post history of an infection at the previous site.
- 3 The cases not at risk cases. The infection of wound in these cases was the postoperative effect of the surgery.

The degree of sepsis was classified as follows:

1. Septicemia only
2. Septic thrombophlebitis
3. Shock sepsis
4. Septic pneumonia
5. Septic meningitis
6. Wound healing by granulation

For practical purposes, infection at the first three degrees can be regarded as minor infection which does not appreciably delay the patient's recovery or discharge from hospital. 56.1 per cent of cases of infection according to data records came into this category.

The monthly report detailed the organisms isolated in each case and their antibiotic sensitivities. The sub-organisms as a part culture or the predominant organisms in a mixed flora culture, was classified as the primary invader and other

organisms, perhaps appearing only in later cultures, as secondary invaders.

The recording system enabled classification of cases according to the surgical sub-specialties in which they occurred.

#### Working Environment During the Survey Period

Figure 1 shows that there was little change in the theatre work load during the period but there was an apparent increase in the number of clinic cases during the later years. The reason for this was that while the whole load of hospital work increased, certain types of procedures, such as manipulation of fractures which was done at the theatre at the start of the survey, were later done in the casualty department.

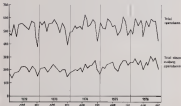


Fig. 1. Monthly operating theatre work load, 1950-1954.

The range of work and the proportion of theatre to out-patient patients did not change during the five year period.

#### Modifications to operating theatres

At the start of the survey period the condition of the main theatres was considered key for the following reasons:

- 1 The air intakes were completely clogged.
- 2 The positioning range of floor of the suspended in the theatres usually within order of 2 ft. position of water a position 40 ft. below deck level.
- 3 There was too considerable leakage due to structural building work and the lay up room the position of the theatre, some things below a deck to display up room.
- 4 The scrub up rooms were open to the theatre.

Modifications were carried out during the period June 1973-July 1974, during this period about half the operations were done in an out-patient theatre sited in a clinical ward. The air conditioning system was re-designed to give the correct pressure and direction of airflow. The theatres were isolated from the maintenance work room by airlock hatches and the lay up room was completely isolated from the maintenance work room. The scrub up rooms were isolated from the theatres by double doors which automatically opened and closed by elbow switches.

The third theatre, which does not have a positive pressure ventilation system,

remained unmodified apart from minor structural alterations.

#### Modifications to technique

There was no alteration in the method of skin preparation or scrub up techniques during the period. Most surgeons used chlorhexidine in spirit or saline in spirit as the skin preparation and washed their hands in Flouresol, Betadine or Iodine-20.

During the five year study were worn while doing work throughout what they were abandoned in conformity with the practice at other hospitals in the Wessex region. No measures in wound upon resulted. As shown this time the practice of wearing disposable polythene gloves for taking down the dressings in selected cases was introduced.

During the first two years of the survey culture techniques suitable for growing *Staphylococcus* were not in use and it is probable that a number of these infections were missed during that time.

#### Results

The main purpose of the survey was to determine the overall rate of infection in clean open operations. The results are shown in Table 1 (Fig 1). They probably

TABLE 1. SUMMARY OF SURVEY DATA COLLECTION

	Class I only	Class II only	3 Theatres
1973	2,274	40	1.75
1974	1,428	41	1.39
1975	1,508	40	1.38
1976	1,463	33	1.28
1977	7,111	90	1.31
	13,784	174	1.26

Proportion of clean open theatre in Class I  
major open theatre in Class II

52.1%

47.9%





surgery and complete absence of sepsis in the low ENT procedures which could be classified as 'clean' cutting operations are notable.

It was not possible to compare the sepsis rate in closed cases between the underdeveloped small wards and the older open wards over the five year period because their populations differed and were not constant. However, figures taken for a short period suggested that the underdeveloped wards had lower infection rates despite the fact that they accepted more septic cases, whereas no septic cases were admitted to the 'clean' open wards: a separate ward was kept for the admission of male septic cases.

### Organisms Responsible for Sepsis

The range of organisms grown throughout the period is shown in Tables 3 and 4. These include patients admitted with sepsis as well as those developing sepsis for the first time in the hospital. No significant change in the pattern of infecting organisms is shown with the exception of the emergence of *Stenotrophomonas* as an important pathogen in the later years. Monitoring of this organism only began in November 1973 because suitable cultivation techniques were not available until then. Since completion of the survey the incidence of this organism has continued to increase, as the first eleven months of 1977 it was isolated on the tests

TABLE 3. THE 15 MOST COMMONLY GROWN ORGANISMS RESPONSIBLE FOR SEPSIS

	Cult. nos.	Sept. abs.	Non-sept.	# of cases	Patients	<i>Stenotrophomonas</i>	<i>Staphylococcus</i>	<i>Pseudomonas</i> <sup>1</sup>	<i>Enterobacteriaceae</i> <sup>2</sup>
1973	232	43	36	37	14	18	1	—	1
1974	245	38	37	3	4	2	1	—	1
1975	138	31	32	42	4	4	1	—	1
1976	132	31	30	14	14	1	1	27	1
1977	206	48	39	33	9	9	4	23	4

<sup>1</sup> First isolated November 1973.

<sup>2</sup> Not isolated before 1974.

TABLE 4. ORGANISMS GROWN IN 54 PATIENTS WITH SEPSIS

	Sept. abs.	Sept. abs.	Sept. abs.	# of cases	Patients	Non-sept.	Sept. abs.	Non-sept.	Non-sept.
1973	18	25	11	33	13	18	1	—	1
1974	14	33	15	4	10	9	1	2	1
1975	9	25	27	13	3	4	1	1	1
1976	11	9	35	24	15	4	5	24	1
1977	20	9	32	12	12	17	1	13	1

<sup>1</sup> Sepsis (sepsis in the culture or the organism) responsible for the sepsis.

<sup>2</sup> Organisms in the culture but not responsible for the sepsis.

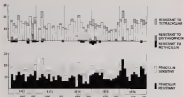


Fig 3. Distribution of depth of progress in pusillula and other infections.

principal cause in 33 occasions and as a secondary trouble on six occasions.

*Klebsiella* was only monitored from February 1971; the survey shows a marked decrease in its incidence over the survey period.

The antibiotic sensitivities of *Staph. pyogenes* are shown in Fig 3; it confirms the impression that penicillin sensitive strains of the organism have virtually disappeared from the hospital scene though comparatively little resistance to tetracycline has developed and virtually none to erythromycin. The apparent incidence of a few *Staphylococcus* to methicillin may well be a statistical artifact.

### Discussion

The investigation of wound sepsis rates is an expensive one. It is not possible to carry out large matched pair trials in which all parameters e.g. age and sex of patients, type of surgery, wards and therefore staff, surgical and nursing staff and surgical and nursing techniques remain constant over a long period, with only the one factor under investigation changing. Even changes in the

weather may be important (Mallard, 1965). Nevertheless it is important to try to establish criteria against which future progress can be objectively measured and the patient's compensation attempts to do this for an acute general hospital similar to many others in this country.

Few long term surveys of this sort appear to have been done. Longstaff (1965) carried out a five year survey covering 8,881 operations at a large central hospital in Sweden; the overall sepsis rate at discharge was 1.6 per cent, almost identical to the 1.4 per cent found in our cases. He found that cases operated on towards the end of the day had higher sepsis rates than average (4% for afternoon cases).

Mallard (1965), in a very comprehensive five year survey of general surgical cases, found an overall sepsis rate of 15.39 per cent out of 3,683 cases, with a rate of 7.11 per cent in the 2,715 clean cases. He did not find any correlation with the number of sepsis cases admitted to the hospital or with upper respiratory infections in staff and did not find any higher rate of sepsis in cases operated on late in the day.

Smith *et al* (1974) carried out a two year survey from 1966 off in new surgical wards, and again from 1971-72 in the same wards. Their sinus tract infection rate was 3.4 per cent in the first period and 5.4 per cent in the second. These were presumably general surgical wards.

Shawcross, Williams and McDonald (1966) carried out a survey of 11 hospitals over a period of two years, covering 3-275 general surgery and orthopaedic cases. They found the sepsis rate in clean cases varied in different hospitals from 1.5 per cent to an orthopaedic hospital to 26.4 per cent, with an average overall rate of 8.7 per cent. They found that only about half the wounds from which organisms were grown developed clinical signs; however, clean sepsis wounds varied on average delay of eight days in discharge from hospital.

There has always been speculation on the routes by which wounds become infected and the importance of various factors which determine whether organisms introduced into a wound flourish and produce sepsis. A detailed study of the bacteriological environment of 1 000 surgical wounds was carried out by Davidson, Smith and Smyth (1971). They found pathogens in the wound at the end of 7.1 per cent of operations though in only 0.8 per cent was *Staph. pyogenes* isolated — but this was all from eight developed wound sepsis.

It is generally considered that a high proportion of deep wound infections are due to contamination with airborne organisms at the time of operation. Chandler (1972) has shown how deep infections in total hip replacement surgery were reduced from 7 per cent to 0.5 per cent by measures taken to reduce airborne infection and Sanderson and Bentley (1970) confirmed that a vertical laminar flow ventilation system could markedly reduce wound contamination in the theatre. The general emphasis on infection control is on attempting to reduce airborne contamination by improving

ventilation systems, the reduction in sepsis which occurred in this survey after comparatively simple improvements in the theatre ventilation systems suggests that approach. Little attention has so far been paid to providing similar standards of ventilation in ward dressing rooms.

Direct contamination of wounds in the theatre by the hands and instruments of surgeons and nurses is probably not only with modern instrument sterilisation and packing techniques and the use of hexachlorophene or povidone iodine in hand washing, it may not be as easy to ward drainage; in theory a non-touch drainage technique should prevent this sort of contamination but in practice it is often not possible to remove post-washed water drainage in an entirely non-touch fashion and the use of disposable plastic gloves to prevent contamination of the surgeon's hands when taking down infected drainage should help to prevent cross infection in the ward by this route.

If organisms do find their way into a wound at the time of operation their numbers may be reduced and hence the chance of infection lowered, by irrigating the wound before closing it. It is probably the mechanical effect of the washes which is effective rather than any antimicrobial contents it may have. However insufficient alcohols have been used in the wound and the topical use of antibiotics as a powder in the wound or incorporated in bone cement (Shawcross 1977) have been shown to reduce sepsis rates. The use of systemic antibiotics since its first application mainly condemned by bacteriologists 25 years ago has come back into favour for operations such as total joint replacement now that antibiotics with broader spectra and less apparent risk of producing resistant strains of organisms are available.

The fight to eliminate wound sepsis is a continuous process which demands constant observation of sepsis rates and re-

approval of aseptic control methods. Effort should be concentrated on procedures which can be shown to be effective rather than on late harvested results of unproven value. It is easy to introduce an effective aseptic routine but very difficult to ensure that it is in fact carried out by numerous generations of nursing and other staff. The provision of efficient ventilation systems in operating and hospital administration must be viewed as the most economical way of achieving the necessary safety standards. Above all, it is necessary for a routine of informed staff to maintain a lively interest in infection control in the hospital, at a money which must not be allowed to go by default.

#### Summary

1 The results of a prospective five year survey of surgical wound infection in one general hospital are reported.

2 The material included 13 123 clean open operations. The overall wound infection rate at three weeks varied from 3.71 per cent in 1972 to 1.63 per cent in 1976, with an average of 1.86 per cent. Of these infections 56.1 per cent were classified as trivial and did not delay the patient's recovery.

3 The infection rates were highest in general surgery (5.31% to 3.92%) and orthopaedics (4.66% to 3.82%) in which gynaecology and otolaryngology they were almost invariably below 1 per cent.

4 No significant change in the incidence of the various different infecting organisms was noted during the period with the exception of the emergence of *Stenotrophomonas* as a pathogen in the later years and a decline in the incidence of *Staphylococcus*.

5 The proportion of patients receiving drains at high prophylaxis increased from 77 per cent to 85 per cent during the period

but there was no increase in resistance to antimicrobials introduced as prophylaxis.

6 Recent trends in wound control are discussed. The importance of continued study of infection rates and control methods, and of ensuring that aseptic techniques are not only effective but are actually practiced is stressed.

7 Modifications to the ventilation of the operating theatre significantly reduced the incidence of wound sepsis.

#### Acknowledgements

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## Hypertension and Alcoholism

D. H. Majes

### Introduction

Thirteen patients with a raised blood pressure were found in the course of nine months when assessing patients who were suspected of being heavy drinkers or alcoholics. A number of these patients had been previously known to have had a raised blood pressure in some cases before there was any suspicion of problem drinking. Some of these patients had been treated with hypotensive drugs but, with abstinence from alcohol patients could become normotensive or nearly normotensive without medication.

### Previous Studies

Solomon (1981) and Krumpal and Lange (1977) observed a rise in the blood pressure on average by 30 per cent on the third and fourth days of delirium tremens. Lane (1983) was the first to suggest a connection between alcoholism and hypertension. He found that in *sevrants* called to the soldiers used between 42 and 45 the height of their blood pressure correlated positively with their habitual alcohol intake. Jahn and Turner (1952) found elevation of both diastolic and systolic pressures among patients hospitalized for chronic alcoholism. While Schnall and Weiner (1955) found the corrected blood pressures of 3 648 alcoholics on average lower than in the general population. Shah (1967) and Durrant *et al* (1967) showed that those who took alcohol, especially those who drank

heavily, showed a higher corrected blood pressure than non drinkers of the same age. McNeil (1970) described hypertension as a frequent but not inevitable sign of impending delirium tremens in otherwise normotensive patients. Williams *et al* (1971) found evidence of hypertension in one sixth of 1 200 alcoholic patients referred to an alcohol clinic attached to a teaching hospital. The hypertension was described as being moderate, fairly long standing and responding incompletely to conventional hypertensive medication but reacting promptly with withdrawal of alcohol. Males (1965) in the USA found that 23 per cent of 160 consecutive admissions to a community hospital were alcoholic and that in 10 per cent of admissions alcohol had played a major role. Green (1960) in Australia considered that 33 per cent of 1 800 patients consecutively admitted to the medical wards of a public hospital were alcoholics and that 3.4 per cent of admissions were directly due to alcohol. It is unlikely that the medical wards of a tertiary hospital are very different.

The possible mechanism of alcohol induced hypertension may well be associated with autonomic over activity as suggested by McNeil (1970). The hypertension could be caused by a rise in catecholamines associated with mental stress and alcoholism can be stressful particularly during withdrawal. Alcohol may also directly or indirectly activate



## **A Radiological Follow-up Study of the Effect of Asbestos in Dockyard Workers at Devonport**

G. H. Grant McMillan, G. Shoen and R. Freelybridge

### **ABSTRACT**

*The 80 per cent random sample of asbestos-exposed employees at Devonport Dockyard (see comment) in 1946 has been re-examined to determine the extent and progression state of asbestos-related lesions. Two per cent of these men are radiologically confirmed asbestos-related disease in 1968 were found to have such a confirmed 30 persons of this group confirmed lesions in 1968 and developed radiologically others.*

### **Introduction**

In 1946 a 80 per cent random sample of 15 000 civilian men working at HM Dockyard Devonport was studied to determine the prevalence of asbestos-related pulmonary and pleural diseases and abnormalities and to relate this to exposure to asbestos and smoking habits. The 1418 men (94% of the total sample) who responded in 1946 have been studied after an interval of eleven years to determine the attack and progression rates of these diseases and abnormalities.

### **Methods**

In 1957 728 men (51.5%) in the original group were still employed at a similar post capacity in the Dockyard. They were asked to attend for examinations and to complete a questionnaire which related the occupational smoking and respiratory symptoms data. Examiners (drinks) discussed the nature histories with each man to ensure accuracy and consistency.

Tracing the remaining 688 men began with searches of mortality records at the Medical Research Unit and discharge records at other departments. The majority of the 168 men who were ultimately found to

have died were identified in this search. The remainder were traced from Trade Union records registers maintained by the Department of Health and Social Security and the Office of Population Censuses and Surveys (OPCS) or by relatives of the deceased. Copies of the Certificate of Cause of Death were obtained.

Formerly seamen who had moved to civilian posts in the Civil Service were approached at their business address. Attempts to contact ex-employees began with a letter to the last address in the Dockyard records and if this did not provide a response further letters were sent to addresses collected from Electoral Rolls, a series of telephone directories and, in the case of the younger men, to the address given on their entry to employment on the presumption that this was the present home. When these measures failed a letter was forwarded to the man by the Department of Health and Social Security. We were not informed of the man's whereabouts. Finally the names of the few men who had not replied were sent to OPCS to determine if they were dead or alive.

Ex-employees and selected Civil Servants in the Plymouth area were invited to attend the Research Unit for examinations. Early morning and night sessions were provided for men working in other industries and transport was made available to the sailors. Those living elsewhere in the UK or abroad completed a questionnaire and were a report at their local hospital under arrangements made with their present practitioners.



### Examination

In 1966 the initial radiograph was the 180 × 180 mm fluororadiograph produced by the Oxford camera coupled to a 200 mA x-ray generator and photometer. Men were recalled for further radiography if an abnormality was suspected on this radiograph. During the re survey the same type of film was taken by the same camera and staff. A film addition of the same unit's posterior anterior chest radiograph was taken on 40 × 40 cm x-ray film using a Fisher Hiscrope condenser discharge unit. This second radiograph was taken to measure the film positive result rate, an important factor as many of the men were employed in other industries or were aged and required transport to the Research Unit.

Ideally we would have re-taken the 1966 180 mm radiographs, to measure the constant in the light of experience in the intervening years. This was not done because confirmatory radiographs would not be available for men with a 180 mm radiograph considered normal in 1966 but abnormal on re-taking. Therefore for the purposes of this survey we sought to apply the diagnostic criteria used in 1966 to the 1877 180 mm radiographs. This meant including minor degrees of asbestiform angle blurring and all but the most obvious diaphragmatic pleural plaques from the results but men with such abnormalities were investigated.

The 180 mm radiograph was first read by one of us (GS) to determine any need for repeat clinical action and then by two of us independently (JHGM and GS) to record any abnormalities of abnormality. If such an abnormality was suspected the large film was read and if this confirmed or did not fully discuss the emphasis the man was recalled for further investigation.

All those recalled had left and right 45° oblique chest radiographs taken to assess the pleural change more fully and were interviewed by one of us (JHGM) to verify

the occupational and smoking history and to assess symptoms. Those with pleural changes other than very minor pleural plaques were examined and pulmonary function tests were performed when there was any suspicion of involvement of the lung periphery. Men with normal radiographs were informed by letter.

A different procedure had to be adopted for the men living abroad or in other parts of the United Kingdom who agreed to take part in the follow up. These general practitioners was asked to arrange for posterior anterior and both 45° oblique chest radiographs to be taken locally.

The PA radiograph was used in the screening film, and for the purposes of this survey only changes which we considered would have been apparent on a 180 mm radiograph were considered. The oblique views were used to confirm or discuss our suspicion. When an abnormality was confirmed this information was passed to the general practitioner together with guidance on management. Men with normal radiographs were informed of this.

### Diagnostic criteria of asbestos related abnormalities

The benign pleural abnormalities attributed to asbestos exposure are fully described in the report of the original survey (Grove and Tompkins, 1968). These comprise discrete plaques of pleural thickening characteristically bilateral and which may be calcified and usually occur of diffuse pleural thickening often bilateral frequently involving the costophrenic angle and with an asbestos related increasing progressively more basal as it takes into the cranial area of the lung field. The latter abnormality is the result of a pleural reaction with effusion which may persist as an acute episode with pleural pain but is often an insidious process detected fortuitously on routine radiograph examination.

We now believe that it is most unusual for

calcification is seen as diffuse thickening of the pleura and that where calcification is seen in the presence of diffuse thickening this is evidence of the co-existence of plaques. In the original paper the term extensive pleural thickening was used to describe the diffuse changes. We have come to use the latter term to avoid confusion as simple plaques may be extensive in size and number.

As before cases in which radiographed features of pulmonary fibrosis predominate form a small but clearly recognizable group and a very low threshold of suspicion was maintained in the selection of cases for further examination.

#### **Classification**

The abnormalities were classified as simple pleural plaques, calcified pleural plaques, diffuse pleural thickening and pulmonary fibrosis.

A pulmonary exposure in all cases was adequate evidence of exposure to asbestos. Pleural plaques were diagnosed only when there was sufficient evidence from the PA and 45° oblique radiographs clearly to differentiate the shadows from compensatory changes, and in the few cases of unilateral diaphragm thickening, when there was no evidence from the roentgen and radiograph of a history of injury at or near the site.

Diffuse pleural thickening was diagnosed only in the absence of a history of asbestos pleurocytosis or pneumosis.

The diagnosis of pulmonary fibrosis was accepted only when the typical radiographic appearances and peripheral basal ticks were detected and when there was indication of the pre-inspiratory hyper- to less than 75 per cent of the predicted value in the presence of a restrictive ventilatory defect pattern on spirometry and/or lung volumes.

When two or more abnormalities co-existed the man was allocated to one class and a note made of the presence of the other abnormality. Therefore in the tables

a man with pulmonary fibrosis and calcified pleural plaques is shown as pulmonary fibrosis and with plaques and diffuse thickening is allocated to diffuse thickening.

Both readers were required to agree on the final classification of the abnormality. **Assessment of Exposure**

Although stringent measures to prevent the exposure of employees to asbestos dust was introduced in the Dockyard in 1944 the effort was not immediate and we consider that while the risk of exposure diminished year by year, full protection was probably not achieved until 1950. Therefore we have used that year as the end point of all exposure in the men involved in this study.

In the original survey the men were allocated to one of four asbestos exposure groups numbered in descending order of risk of heavy exposure. The basis for allocation was the job in which the man had spent the major part of his working life in the Dockyard. We have found that this method resulted in some men who were in danger or supervisory posts in 1944 but had been asbestos workers in their working life being placed in group 4 which under-represented their risk of exposure to asbestos.

On this occasion we have re-examined each occupational history and have allocated the men to groups on the basis of the occupations with the highest risk, calculating his "time in exposed job" and "time since last exposure" in relation to that occupation. Additionally in 1966 painters and boatbuilders were allocated to group 4, the lowest risk. We have now found that these exposure groups with that of other occupations group 2 and have re-allocated them to that group. The occupations in each exposure group are shown in table 1 and the changes in the number of men in each group in table 2. All group related rates in this report are based on the re-defined groups.

TABLE 1. Occupational exposure groups

Group 1	Group 2	Group 3	Group 4
Insulator	Electrical fitter	Builder	Electrician
Auto chain assembler	Coal face worker	Refuse	(Mechanical fitter)
Refuse chain assembler	Refrigerator	Barman	
Automotive mechanic	Weld fitter	Joiner	
Polisher (iron)	Refineries	Plumber	

TABLE 2. Comparison of size of exposure groups by 1965 and 1977 number of allocations

	Exposure group				
	1	2	3	4	All groups
Number in groups in 1965 report	42	358	330	554	1484
Number in groups after 1977 re-allocation	51	408	330	544	1433
Difference	+9	+50	0	-10	0

## Results

### Response

A total of 1812 men were re-examined, 76.5 per cent of the 1965 respondents and 90.2 per cent of the survivors (table 3). The response rates among the survivors varied between the exposure groups from 55.4 per cent in group 1 to 77.0 per cent in group 4.

The distribution of age and time since first employment in the occupation used for group allocation (i.e. those doing first exposure<sup>1</sup>) of the respondents are similar to those of the survivors (tables 4 and 5). The non-response rate is highest in those under 35 years of age and 15-19 years since first

exposure, and in the men who were 64 and over (most of whom were retired).

The majority of the 358 men respondents who refused (table 6) were ex-employees. Several men who had emigrated were contacted as they lived in South Africa and New Zealand, but these emigrants could not be contacted. They were all relatively young men. African men were absent during the survey and would not attend. Only two men were non-responders.

The persistence of asbestos related lesions in the sample in 1965 is shown in table 7. Six of the 63 men with chest lesions refused to attend in 1977, 16 had died and 40 were re-examined (table 8).

TABLE 3. Responders and non-responders to postal questionnaire

	All	Expense group			
		1	2	3	4
Total in 1977 sample	1414	34	466	333	581
Number QD known to be dead	98	0	49	23	26
	(11.4%)	(0%)	(10.5%)	(6.9%)	(4.5%)
Number of survivors	1246	45	446	310	445
Number attempted for postscript	1012	44	366	264	338
Percentage of total sample who attended	71.6	32.4	75.3	76.4	63.2
Percentage of survivors who attended	82.4	32.4	82.4	84.2	73.2

TABLE 4. Relative (and absolute) age frequency distribution of survivors, responders and nonresponders in 1977 and at date of death

Group	Age (years)					
	< 25	25-34	35-44	45-54	55-64	≥ 65
Survivors	0 (0)	25.4 (1267)	18.3 (1093)	15.5 (1008)	21.5 (1005)	19.5 (1244)
Responders	0 (0)	30.4 (106)	30.1 (103)	30.3 (104)	23.7 (740)	15.5 (159)
Nonresponders	0 (0)	35.6 (18)	15.6 (32)	10.3 (24)	11.8 (26)	27.4 (64)
Dead	0.6 (1)	1.8 (5)	4.3 (17)	16.5 (127)	34.9 (280)	42.9 (373)

TABLE 3. Relative (and absolute) distributions of time spent fish exposed to pollution at work for survivors, non-survivors and non-exposed.

Group	Time since fish exposure (years)				
	10-19	20-29	30-39	40-49	50+
Survivors	85.8 (49%)	27.4 (34%)	15.8 (24%)	12.6 (19%)	4.5 (7%)
Not exposed	37.3 (32%)	30.7 (31%)	20.3 (20%)	13.7 (13%)	3.0 (3%)
Non-exposed fish	50.8 (18%)	17.8 (6%)	17.9 (6%)	7.7 (3%)	8.9 (3%)

TABLE 5. Exposure for non-exposed in 1977 among survivors of 14% and 23% exposed in 1962.

	Number of men	Exposure group			
		1	2	3	4
Exposed	208	2	69	47	94
Non-exposed	41		7	4	
Isak	79		4	4	7
Unexposed	2				2
All exposed	230	2	80	55	103

**Table 2.** Correlation of asbestos-related disease in shipwrights' groups in 1945 and in 1950

Exposure group	Number of men recruited	Number lost (2) (3) (4) (5)	Simple pleurisy	Calcinified pleurisy	Diffuse pleural thickening	Pulmonary fibrosis
1	34	12(35.3)	13	2	2	3
2	468	22(4.7)	14	3	2	0
3	155	10(6.4)	8	3	2	0
4	344	14(4.1)	4	1	0	1
All groups	944	42(4.5)	33	9	6	4

**Table 3.** Exposure in 1937 among men with asbestos-related disease in 1950

Asbestosis in 1950	Number of men	Re-recruited in 1937	Dead	Refused
Simple pleurisy	43	34	5	4
Calcinified pleurisy	7	4	2	1
Diffuse pleural thickening	9	2	4	1
Pulmonary fibrosis	4	1	3	0
All Asbestosis	63	41	14	6

Table 2. Verified cause of death of 152 men related to presence of asbestos plaques between 1966 and 1977

Type of-cause	Number of deaths	Cause of death			
		asbestosis and mesothelioma carcinoma	bronchitis	bronchial carcinoma	Other
Simple plaques	3			1	4
Excised plaques	2	1			1
Diffuse pleural thickening	4			1	3
Pulmonary carcinoma	3	1	2		
<b>All asbestos related causes</b>	<b>12</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>12</b>
<b>All asbestos related causes</b>	<b>152</b>	<b>2</b>	<b>1</b>	<b>16</b>	<b>130</b>

### Deaths

By 1977, 166 (11.9%) of the men examined in 1966 had died; the percentage varying between the groups (table 2). The certified causes of death of each of these men is summarized in table 3.

Four of those with an asbestos related lesion in 1966 subsequently died of diseases directly related to asbestos exposure but only one of the four did not have pulmonary fibrosis in 1966. This man had excised pleural plaques and subsequently developed pulmonary fibrosis then bronchial carcinoma. Two other men from the 43 died of bronchial carcinoma without asbestos.

Among the 152 who had no asbestos

related lesion in 1966 and were dead by 1977, one died of asbestos and one of mesothelioma. Eighteen men died of bronchial carcinoma.

### Progression of asbestos related lesions between 1966 and 1977

Among the 41 men with their chest x-rays in 1966 who were re-examined in 1977 we found that four of the 19 who previously had simple plaques and one of the two with diffuse pleural thickening had developed pulmonary fibrosis (table 10). One man with excised plaques had developed no existing diffuse pleural thickening.

Three including those known to have died,

**TABLE 3b** Prevalence of asbestos related pleural abnormalities and disease in 1977 and 1981 (1981 data available for 1985 and 1977 re-examinations in 1982 and 1983)

Exposure level in 1966	Number of men	Simple pleurisy	Complex pleurisy	Bilateral pleural thickening	Pulmonary fibrosis	Bronchovascular emphysema and pulmonary hypertension	Group score as % death
Simple pleurisy	39 (53)	24	8	4	4		65
Complex pleurisy	4 (13)		3	4		10	61
Bilateral pleural thickening	2 (6)			1	1		65
Pulmonary fibrosis	1 (3)				1 (1)	60	68

The figures in brackets in the column of men who were dead in 1977

at least six of the fifty nine men whose pleurocentesis was confined to the pleura in 1966 had developed asbestos in the intervening 11 years. Two of these men were in the highest exposure group, three were in group 3 and one in group 1. The age range was 45-70 years, range of time since first exposure 23-47 years, and of time in the exposed job 16-29 years. All but one had a history of tobacco smoking.

**Asbestos and new cases of asbestos related lesions**

Nearly seven of the 571 men with no asbestos related lesion in 1966 who were re-examined in 1977 were found to have developed such an abnormality (table 1). Two had pulmonary fibrosis and one a pleural mesothelioma. Thus given an attack rate over 11 years among the survivors of approximately 10 per cent for all types of

lesion, 8.5 per cent for pulmonary fibrosis and 0.5 per cent for mesothelioma. A dose response relationship is apparent with the highest rates in group 1 and lowest in group 4.

In addition one of the 151 who were dead in 1977 had pulmonary fibrosis and one pleural mesothelioma. Thus the attack rate in the survivors and dead together (119 men) is 2.5 per cent for pulmonary fibrosis and 0.7 per cent for mesothelioma.

There were more of asbestos related lesions in the survivors are related to the time from first exposure to 1977 in table 2) and to time in the exposed job (table 3). With the exception of group 1, the attack rate is very slow until at least 20 years have passed since first exposure and in all exposures groups it less than 1 per cent per year since last examination in those with



TABLE 12. Deaths aged 21-49, 1951-1977, classified according to the age at exposure to asbestos, 1946-1977, and to the age at death, 1951-1977

Exposure group	Number of men involved	Deaths aged 21 with asbestos-related diseases	Deaths played	Calculated players	Deaths played of asbestos	Deaths asbestos	Deaths asbestos
1	24	8 (33.3%)	3 (12.5%)	3 (12.5%)	4 (16.7%)	1 (4.2%)	
2	224	34 (15.1%)	23 (10.3%)	8 (3.6%)	6 (2.7%)	2 (0.9%)	1 (0.4%)
3	253	20 (7.9%)	11 (4.3%)	7 (2.8%)	2 (0.8%)	1 (0.4%)	
4	225	28 (12.4%)	10 (4.4%)	6 (2.7%)	6 (2.7%)	2 (0.9%)	
All groups	506	90 (17.8%)	57 (11.3%)	24 (4.7%)	18 (3.5%)	6 (1.2%)	1 (0.2%)

#### less than 10 years exposure

Among the six men who had developed pulmonary fibrosis, one had a job in the group 1 exposure risk for 15 years and started working in that job 22 years before the disease became apparent. The other five men had been in jobs with lower exposure risk for 10-40 years, starting 17-50 years before diagnosis. The only case of mesothelioma was in a group 2 job for 10 years starting 43 years before the tumour was found. All seven men had a history of asbestos smoking.

#### Effect of smoking

The prevalence of asbestos related abnormalities in all 1015 men examined in 1977 is shown in table 14 and related to smoking habits in table 15. The overall prevalence in smokers and ex-smokers is shown. There were 101 of non smokers and

no cases of asbestos related disease in contrast to 16 cases of abnormalities were found among the non smokers.

#### Asbestos prevalence rate

As several of the non-responders and of those who died from diseases unrelated to asbestos exposure were known to have asbestos related benign pleural lesions, we have pooled the information and then calculated the prevalence rate of all asbestos related lesions in the 1015 men examined in the original study.

This information is related to age in table 16. The ages are those of the men in 1976 and then by comparing the prevalence rates in each group in 1966 and 1977 the change in the same groups of men can be assessed. In each age group over 25 years of age in the whole sample of 1015 men for 1977

**TABLE 12.** Prevalence of asbestos-related lesions among the 571 survivors of men with asbestosis in 1965 who were re-examined in 1972, related to exposure group and time since first exposure in 1957

Exposure group	All	Time since first exposure (years)				
		10-19	20-29	30-39	40-49	50+
1. Examined	28	6	7	4	3	0
Abnormal	8	1	4	2	1	0
Rate %	27.5	15.7	25.6	30.0	20.0	0
2. Examined	354	113	113	71	44	11
Abnormal	37	1	7	9	10	2
Rate %	10.5	0.8	7.3	12.7	22.7	18.2
3. Examined	253	75	94	47	34	8
Abnormal	26	0	6	14	3	1
Rate %	10.3	0	6.4	29.8	15.1	12.5
4. Examined	339	131	83	71	41	9
Abnormal	28	7	9	6	3	1
Rate %	7.8	5.3	8.4	8.5	12.0	11.1
All Examined	571	323	369	193	121	28
Abnormal	99	9	30	31	21	4
Rate %	16.0	2.8	10.3	16.1	17.3	14.3

TABLE 13. Prevalence of asbestos related lesions among the 371 employees of men with no lesions in 1954-55 were re-examined in 1979, related to exposure group and time spent in exposed job in 1979

Exposure group	all	Time in exposed job (years)					
		4-10	10-19	20-29	30-39	40-49	50+
1. Normal	29	5	10	7	5	0	0
Abnormal	5	0	3	1	1	0	0
Ratio 5	27.6	0	41.7	74.3	60.0	0	0
2. Normal	304	110	111	70	62	17	1
Abnormal	22	1	14	9	11	2	0
Ratio 5	10.5	0.8	12.8	12.8	26.4	11.8	0
3. Normal	150	75	83	51	38	10	0
Abnormal	26	1	3	12	7	1	0
Ratio 5	16.2	1.3	3.0	23.2	21.9	10.0	0
4. Normal	100	105	96	74	49	9	1
Abnormal	26	6	3	8	3	2	0
Ratio 5	3.8	3.7	3.2	18.8	16.2	22.2	0
All Normal	671	295	304	200	130	36	2
Abnormal	97	8	20	30	28	5	0
Ratio 5	10.0	2.7	3.5	14.9	19.1	13.9	0

**TABLE 2.** *Relationship of subjective related lesions and abnormal responses found in ECG, chest X-ray, and at 2000 and 4000 Hz*

Exposure group	Number of men examined	Number found with subjective related lesions	Types of Lesion				
			Simple plaques	Diffuse plaques	Diffuse plaques + myocardial thickening	Pulmonary fibrosis	Interst. nodular, sarcoidosis
1	44	30 (68.2)	18 (40.9)	0 (0.0)	1 (2.3)	4 (9.1)	
2	244	40 (16.4)	21 (8.6)	15 (6.1)	4 (1.6)	4 (1.6)	1 (0.4)
3	201	56 (27.8)	19 (9.4)	40 (19.9)	3 (1.5)	2 (1.0)	0 (0.0)
4	244	35 (14.3)	16 (6.5)	0 (0.0)	0 (0.0)	2 (0.8)	0 (0.0)
All	733	161 (21.9)	64 (8.7)	55 (7.5)	5 (0.7)	12 (1.6)	1 (0.1)

prevalence rate exceeds that in 1964 by approximately 5 per cent suggesting a linear relationship between the passage of time and the appearance of the lesions. This interpretation is reinforced by the linear increase in prevalence related to time since first employment in the exposed occupations (table 17). The length of time on that job appears to be less critical in all but the group with the heaviest exposure (table 14).

#### Discussion

Many men who have been exposed to asbestos dust at work are probably

concerned about the effect this may have on their health and wish to know the risk of developing an asbestos related disease. The majority of men who are found to have pleural plaques or diffuse pleural thickening on routine health screening ask the question directly. The study was undertaken to help those of us responsible for the care of men who are or have been employed in the Dockyard to advise them with a greater degree of confidence than previously.

The similarities between those examined and all the services lead us to believe that the observed rates are likely to apply to the

Table 13. Prevalence of asbestos-related lesions in 1977 and 1980, as 1977 related to smoking status

Lesion	Non-smokers	Ex-smokers	Smokers
Simple pleurisy	10	27	41
Calcified pleurisy	5	91	19
Bilateral pleural thickening		1	13
Pulmonary fibrosis		6	6
Benign lesions			1
All types	15	45	80
Number of men	121	301	449
Prevalence %	5.8	15.0	16.3

marrow in the sample and thus in the Dockyard population in 1966 as the percentage of true and up of the men appear to be more critical than the time spent in the job (with the exception of group one).

The response was relatively high in the higher exposure risk groups and relatively low in younger men. These factors may act together to reduce the observed attack rates while the relatively low response in men over 64 years of age may have the opposite effect. It is generally accepted that prevalence rates for pleural plaques based on radiographic surveys underestimate the true situation.

It is important to emphasize that the attack and progression rates apply to men employed in the Dockyard in 1966. The changes in exposure to asbestos and the relatively high percentage of men demonstrated by the high percentages of the sample found to have left employment as an industrial capacitor in the Dockyard prevent the rate being applied to the 1977 population and we would expect the attack rate in that population to be lower.

Within these limitations we conclude that the overall attack rate for all asbestos lesions is approximately 10 per cent in eleven years. If the relationship between

**TABLE 5.** *Percentage of all reported colorectal tumours in 1966 and 1967, and percentage prevalence rate in 1967, related to age in 1966 and 1967 (see Table 4, 1966)*

Department group	All ages	Age in 1966					
		40-49	50-59	60-69	70-79	80-89	90+
1. Number of men	38	3	5	9	20	16	1
Prevalence 1966	10.1	-	-	31.3	40.0	40.0	-
Prevalence 1967	10.8	-	-	44.4	60.0	56.3	-
2. Number of men	405	140	84	86	87	74	3
Prevalence 1966	6.2	0.7	-	1.2	10.5	18.2	0.0
Prevalence 1967	12.3	0.7	13.7	6.5	23.2	23.0	0.0
3. Number of men	335	55	76	74	42	42	2
Prevalence 1966	3.9	-	-	4.1	6.3	16.7	-
Prevalence 1967	17.0	-	3.3	23.4	15.7	26.2	50.0
4. Number of men	94	37	24	26	15	14	15
Prevalence 1966	8.8	-	-	8.3	3.3	2.8	-
Prevalence 1967	7.8	4.5	6.3	3.5	5.0	5.1	-
5. Number of men	1474	340	479	255	315	250	25
All. Number observed 1966	61	1	4	9	26	26	1
Number observed 1967	76	3	10	24	34	30	5
Prevalence 1966	4.5	0.3	-	3.5	8.3	10.4	4.0
Prevalence 1967	11.2	0.6	2.1	9.5	17.5	12.0	12.0

attack and the percentage of men who have it is suggested that the attack rate can be expressed as 1 per cent per annum. The rate for development of polypostery fibrosis is approximately 0.5 per cent in older years and for carcinoma approximately 0.2

per cent in that period. The latter rate is based on only two cases and must be treated with caution. There were a further two cases who were thought to have metastasoma in life but this diagnosis was not confirmed at autopsy.

TABLE II. Duration prevalence rates of asbestos-related diseases in 1968 for all exposure groups relative to time since first exposure as reported 196 to 1967 or to death if earlier.

Exposure group	All cases	Time (years) since first exposure to 1967 or death if earlier					
		0-10	10-19	20-29	30-39	40-49	50-
1. Number of men Prevalence %	51 31.0	0 -	5 15.3	21 40.8	11 70.7	11 94.3	0 -
2. Number of men Prevalence %	486 18.3	0 -	101 1.2	124 14.2	90 77.4	53 27.0	26 19.2
3. Number of men Prevalence %	199 10.3	0 -	100 -	110 8.2	64 26.8	40 23.3	12 25.5
4. Number of men Prevalence %	144 3.2	13 5.9	105 3.9	114 5.0	140 8.8	52 16.1	24 8.3
All Number of men Number of deaths Prevalence %	914 763 17.7	13 1 7.7	444 14 2.8	379 45 11.4	283 51 68.2	178 43 24.1	67 11 9.4

The risk of developing some asbestos-related disease is appreciably higher in group one and lower in group four occupations. It is almost negligible in most occupations until ten years have been spent in the occupation and twenty years have elapsed

since first employment. Pulmonary fibrosis tends to occur mainly in group one occupations and not at all in those in group four. In the remainder no man developed the disease until after 10 years exposure and 20 years since first exposure.

**TABLE 1B.** *Maximum gross pleural extent of asbestos-related lesions in men and all females exposed to asbestos dust in the years 1940-49 or 1950-59 or 1960-69*

Exposure group	All cases	Time (years) in exposed job to 1950 or to death of worker					
		0-10	10-19	20-29	30-39	40-49	50+
1. Number of men	54	8	19	12	11	1	0
Prevalence %	21	30.0	49.4	30.0	34.5	100.0	—
2. Number of men	456	125	139	28	66	33	4
Prevalence %	12.5	4.3	15.0	18.0	25.8	12.1	30.0
3. Number of men	119	102	56	43	31	18	0
Prevalence %	42.0	3.0	4.1	39.8	39.4	45.8	0
4. Number of men	194	181	135	124	67	28	2
Prevalence %	7.2	3.0	3.4	6.7	11.8	14.3	—
5. Number of men	1414	446	304	255	196	81	1
Number of females	163	14	41	47	49	12	2
Prevalence %	11.7	3.1	10.4	9.6	25.0	14.8	22.0

Approximately 18 per cent of men with pleural plaques or diffuse pleural thickening can be reported to have developed pulmonary fibrosis within eleven years of the pleural changes being noted.

Smoking exerts a considerable influence on the development of all asbestos-related

lesions and especially on the incidence of pulmonary fibrosis.

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## Case Report of an Interesting Gun Shot Wound

A. B. O'Brien

### Introduction

A member of the Marine Regiment left fifteen feet into a wide while on operational patrol in the Davao Province of the Salomon of Guam. The only cough of his firing M16 slipped and he inadvertently discharged his weapon while falling, one of which entered his right abdomen.

This occurred during the mission period when visibility was reduced to five yards or less. The casualty was the Medical Officer of the patrol and initially care was available as pre-extraction or emergency fluid.

The Status of Guam Air Force (GDAF) are able to maintain most casualties to the 35th Joint Service Field Support Team (JFST). A patch within told us how by helicopter (local, 1977). Recovery on this occasion poor visibility resulted in the casualty being transported by members of his patrol for half a mile over rough ground before being placed in the back of a Land Rover where he was driven at 5 mph over rough terrain for three hours before reaching a hospital road.

Meanwhile a Bell helicopter had flown in as close as possible landed on the target road and then stood up the road by the casualty while the pilot walked ten yards in front to meet the incoming Land Rover. Visibility remained at five yards. The casualty was transferred and received the Field Support Team (FST) after ten minutes (long time, but four hours after the initial injury).

### Injury

Clinical examination on arrival showed a low velocity entrance wound on the lower right abdomen with the exit wound over the lower left side of the chest. The patient was severely shocked with BP 60/40 and a rapid thready pulse of 130. Complete abdominal guarding with rigidity was present. No bowel sounds were heard. The patient was able to move his legs but complained of severe loss of SI distribution affecting both feet. Bladder catheterization revealed haematuria. No bone injury was seen on X ray of the lumbar and sacral spine. Immediate resuscitation was given including Dextrose and oxygen. He was taken to theatre one hour after admission.

### Initial Surgery

Exploratory laparotomy was performed through a long mid line incision. Flaps were retracted throughout the abdomen with consequent lateral perforators. The wound had initially struck the inferior border of the right lobe of the liver penetrated the ascending colon just below the hepatic angle passed retroperitoneally across the abdomen to pierce the upper capsule of the left kidney and exit between the posterior angles of the stack and ninth left ribs.

The affected area of liver was resected but not bleeding heavily. It was packed with Stergipon and the haemorrhage controlled. There was a 1½ inch horizontal hole in the

wounding colon.

The affected bowel was resected and the two lumens brought out in separate colostomies. No attempt was made to evacuate the retroperitoneal haematoma around the upper pole of the left kidney. Thorough peritoneal toilet was carried out. Flap and anterior wounds were treated by primary excision, debridement and packed in preparation for delayed primary closure (DPC). A Vesicle drain was inserted. An Argil catheter was introduced into the lower left chest and EBMal blood drained. The patient commenced a course of 17 penicillin and protarginin, the two most appropriate antibiotics at that available at that time (Fig 1).



Fig. 1

#### **Bowel Post-operative Recovery**

At 24 hours a complete collapse of the right lower lobe occurred (Fig 2). This was treated by bronchoscopy and removal of a large plug of mucus. This procedure resulted in no expansion (Fig 3).

By 36 hours the patient had developed a complete paraplegia with loss of muscle



Fig. 2



Fig. 3

power from L2 down, partial sensory loss of L2 to L4, and complete sensory loss of L5 and S1. Further spinal X rays showed no

evidence of injury. A diagnosis of spinal stenosis was made and the drainage tubes were kept open.

A further 500 ml of blood stained fluid was obtained from the drain tube which was removed on the fourth post-operative day. Microscopic examination revealed the following:

Proximal colostomy: functioned as the fourth day but on the sixth day a large swelling developed at the upper end of the wound. Tubules were removed and one liter of pus drained. A further one liter was obtained from the drain tube. However both wounds were healed by the seventh day.

Delayed primary union (DPU) of vent and midline wounds was achieved on the seventh day. These healed successfully.

#### Late Post-operative Recovery at One Month

Great difficulty was encountered in persuading the patient to accept even temporary colostomy. Recovery by one month he was able to look after himself and interact successfully with relatives, friends.

Complete sensation soon returned as far as LA but numbness remained in S1 to S4 distributions affecting the outer two thirds of the sides of both feet, the medial part of insteak and groin and the scrotum and testis. Power returned to normal in the left leg but the quadriceps and hamstrings on the right remained weak.

As would be expected, removal of the catheter caused bladder irritation with overflow and this had to be relieved. However, sensation of bladder fullness was maintained by intermittent clamping.

The patient was transferred to the Urology Medical Centre at three weeks for long stay care.

#### Closure of Colostomy

The patient was returned to the BSFT seven weeks following the second gas short wound (GSW) for final preparation prior

to right hemicolectomy with closure of colostomy. A right paramedian incision was made and the upper right quadrant of the abdomen found to be totally bound down by adhesions. The colostomy was now mobilized and a lower right hemicolectomy performed.

It was not found possible to achieve the hepatic angle of the ascending colon, the lower end of which was consequently placed by purse string and overlying. The terminal ileum was passed in the transverse colon so as not to risk anastomosis in two layers as shown in a diagram follow through at one month (Fig 4).



Fig 4

#### Second Post-operative Recovery

This was unremarkable with a first bowel action on the fifth post-operative day.

Small quantities of clear urine were noted to be leaking from the Y-tube drain tube on the ninth post-operative day. TSP two days later showed a small cyst at the upper edge of the right kidney (Fig 5) in the



abdominal wall had demonstrable only when standing and straining. This area resolved spontaneously by the fourth post-operative day and subsequent EFP was essentially normal. The kidney had been presumably damaged when attempting to maintain the hepatic angle of the ascending colon.

#### **Three Months Following Injury**

Pain continued to return to the left leg so that the neurological deficit here consisted of bilateral complete sensory loss of S1 to S4 and partial motor weakness of peroneal evertors and dorsiflexors in left leg.

Bladder tone was present, but the bladder was emptied by periodic manual external pressure.

The stoma was profuse and there was some loss of solid retention. Complete contraction was obtained by two regular

bowel actions per day at set times. There was no evidence of any blind loop syndrome.

The patient was able to walk with one stick and was discharged in two months hospital care.

In retrospect it is considered that damage to the sacral nerves had been caused by retroperitoneal passing of the round.

#### **Discussion**

How serious an injury this casualty has been only locally mentioned, but the importance of adequate resuscitation prior to surgery cannot be overemphasized. We were somewhat hampered by the limited availability of transfusion solutions but experience showed that any form of conventional blood replacement was inadequate in the majority of cases involving fit young soldiers.

No conventional blood bank was available but a list was held of donors who were prepared to give blood at any hour a notice. These were mainly regulars and limited in number. They were bled on the spot as required demanded, but suffered a considerable shortage so that 10 pints of donors were found to have been incorrectly grouped, the blood being therefore unsuitable in their particular instances.

A thorough exploratory laparotomy is obviously essential but in abdominal gunshot wound a long median incision extending from just below the xiphisternum to above the pubis is needed to facilitate this. A smaller incision may lead ultimately to a missed injury.

Real and extensive lacerations, ripped by the bullet, were treated by sutured under detachment of injured tissue and excision of their edges (Wain 1974). Delayed primary closure was delayed from the usual time to between three because of wound infection within case.

Colonomy is reported for large bowel injuries. Division of affected bowel with the two ends brought out as separate colostomies 4 inch apart is considered

preferable to large colonotomy or Pouch ileostomy procedure. A large colonotomy bag will cover both colonotomies or the distal colonotomy may be closed separately (Personal communication, Lieutenant Colonel M. S. Ozer (Head, Professor of Military Surgery, RANHC)).

Resection neoplasia cover for abdominal cavity should have consisted of bony pelvis, peritoneum IV is healthy and asymptomatic (Figure 1B) but however in this case peritoneum along IV is healthy and used instead of asymptomatic as new of the widespread fecal contamination and the

delay before surgery was possible. No serious wound levels of perforation were possible. IV perforation was considerable in this case.

The neurological involvement appears to have been due to injury of the cauda equina. There has been a continuing return of function since injury, and it is hoped that this will continue. Only time will tell.

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## Dietary Refined Carbohydrate and Urinary Mineral Excretion

L. E. W. Hoelsa, A. Bishop, I. A. Thom and N. J. Blacklock

### ABSTRACT

*Changes in the average intake per capita per day of sugar after the signature of a signed quantity of a signed diet in all. The signed quantity of sugar is a signed quantity in a signed quantity. The signed quantity of sugar is a signed quantity in a signed quantity.*

### Introduction

In observing the significant increase in the incidence of calcium nephrolithiasis within the last 100 years, epidemiological studies have drawn attention to the contemporary dietary changes which have taken place in the more affluent population groups which have been affected by this disease state. Whitehead (1985) commented on the increase in protein and in particular animal protein in their consumption. Blacklock (1976) observed that the dietary intake of sugar based on the same food tables quoted by Anderson was even greater. Green (1974) similarly noted the considerable rise in sugar consumption within the past 100 years in Western communities as one of the possible aetiological factors in the increasing disease and its various manifestations.

An epidemiological study of calcium urolithiasis in Royal Navy personnel showed a greater incidence of obesity than in a control population of seamen (Blacklock, 1965) and a similar finding was made in a civilian survey (Lyon, Meade and Pagan, 1977). While dietary factors have provided an increased intake of calcium in

some stone formers, in the naval men there is a more general finding of either regular or intermittent ingestion of sugar rich foods or drinks, and in some individuals this has amounted to 1 000 grams of sugar per day or more. Furthermore Bishop and Myers, (in press) observed that in the course of a 75 day metabolic study of nine young sailors on a self selected diet, the individual daily consumption of sugar was between 250 and 600 grams. In some consumption was as high as 600 grams on certain days though the overall average sugar consumption per day for the population of the United Kingdom is quoted as 160 grams (Report, 1975).

The importance of sugar in inducing a metabolic effect is enhanced by its general availability as a number of forms which are easily consumable. The tendency for its rapid absorption between meals and therefore at a time when the upper gastrointestinal tract is empty results in a 'bolus' effect on absorption and afterwards (Newcomer and McGill, 1966). The ease with which sugar consumption can reach the high levels quoted is more easily understood with the knowledge that many of the popular soft-drinked beverages have a high content of sugar either in the form of cane or beets or as concentrates in solutions depending conditions, the use of which is widespread and includes shops of the Royal Navy. In this latter situation it is known that large quantities of these drinks are consumed by men when working in hot

environmental conditions. All of the foregoing stresses together as to possible dietary hazards to general, and to the renal community in particular.

An incidental unreported observation made during experiments designed to study the metabolic effects of continuous renal uremia, carbon dioxide on young men (Dumas 1976) was that the average magnitude of base cation of base (approximately 1 liter) by the man in a four hour period resulted in an average threshold increase in the mean urinary calcium excretion (compared with a similar period when base was not consumed). Since the subjects for previous carbon dioxide studies had been allowed a daily volume of alcohol or cola type drinks it became necessary to establish their effects on the urinary excretion of minerals and electrolytes.

#### Materials and Methods

Healthy male volunteers between the ages of 18 and 40, essentially free of cardiovascular and renal disease, were the subjects for the first two studies and controls for the third. The volunteers taking part in the third study were aged between 20 and 30 and all had radiologically proven renal stone.

In the first pilot study which lasted one hour after a standard meal and was controlled relative to metabolic activity, each of eight men was required to empty his bladder and to drink 300 ml deionized water in a glass. An hour later each subject was asked to empty his bladder, the urine volume was measured and an aliquot taken. After this an aqueous controlled phase of the study each subject drank either 300 ml (20% w/v) of cola, light or no water within the next 15-20 minutes. Urine samples were collected at 30 minute intervals for two hours; the volumes recorded and aliquots stored at -20°C until ready for laboratory analysis.

In the second study a similar regimen was carried out on the fasting and non fasting

state with seven new subjects and two men from the previous experiment. The carbohydrate drink in this case was made from the known commercial types supplied to subjects based on 1984 ships and prepared as prescribed though not consumed. Urine aliquots were collected as in the first study.

In the third of these studies the urine composition of non protein, nonchloride was compared with that of water matched controls in the following manner. In the fasting state each subject was asked to empty his bladder and drink one liter of water. Samples of urine were collected every 20 minutes for one hour. Each man then drank 1 unit (≈170 ml) of Mead having the formula:

Glucose 20.1% Maltose 0.1% Fructose 0.1%  
C12H22O11 0.1% Potassium 0.1%  
KCl 0.1% NaCl 0.1% Sodium 0.1% Water 100%

Urine samples were collected every 20 minutes for a further two hours and at the end of this time the volumes of all samples were recorded and aliquots frozen for subsequent laboratory analysis.

All the urine samples collected during these experiments were randomized and assayed blind as follows: sodium and magnesium were estimated by atomic absorption and calcium and potassium by flame emission spectrophotometry on a Perkin-Elmer SP 141 spectrophotometer fitted with an automatic sample changer using methods supplied by the manufacturers. Phosphate was measured by the Fiske and Subbarow (1925) method (modified for use on a LKB Utitrak sample processor and absorptometer and creatinine was measured on the same machine using a method involving the Jaffe reaction. Where urine volumes provided, not used creatinine was diluted using the method described by Kohnberg (1964). Creat and urea levels were estimated by separate methods using Boehringer Mannheim kits and standards.

Samples of the carbohydrate drinks and

beer were analysed for minerals and electrolytes using the same methods and standards as wine samples. Glucose, sodium and lactate were estimated as the alcohol by enzymatic methods using Boehringer Mannheim kits and standards.

### Results

The results of the first study are summarized in Table 1 in terms of the mean half hourly output of the constituents of interest before and after the unaltered stimulus. The significance of the changes in the excretion of each constituent were examined by an analysis of variance in which the main effects of subjects, fluids and timed periods were tested against the residual error variance or, if appropriate, against their significant interactions. These analyses show that the increases following cold or beer was not markedly different from that after a smaller volume of water but there were significant increases in urinary calcium and magnesium after cold and beer and a fall in these divalent cations after water. The pattern of net acid excretion was similar to that of sodium; mean levels fell after water and were raised after beer and cold with peak rates output occurring between 9-1 hour after the stimulus. In contrast there was a significant rise in urinary potassium after water and a large fall in the excretion of this ion after beer and cold. There were no clear cut differences in the pattern of either sodium or inorganic phosphorus output after the beverages and the drinks did not change the excretion of zinc or urea and compared with that after water.

The probability (p) that the changes in the urinary constituents described above could have occurred by chance was less than 0.5.

There were no differences with subject differences in all the measured parameters and there were apparent in the baseline samples taken after the priming drink of 500 ml deionized water and before the

beverages. Some of this variation could be due to the residue of the meals consumed before the experiment was started and it was therefore necessary to maintain the fastings by further observations in the fasting and two fasting state.

Table 2 presents the results of the second study in similar terms to that of Table 1. Generally the main constituent of the urinary constituents but half hourly periods before and after the stimulus which in this case was 500 ml flavored sugar-drink given on separate occasions in both the fasting and two fasting state. It was evident from these results that the changes in the urinary profile induced by the flavored drink or a few water were emphasized in the fasting state and consisted mainly of an increased divalent cation excretion with diminished potassium output. There were no differences in the pattern of excretion of the other constituents which could be attributed to the ingestion of carbohydrates *per se*. In the non fasting state the baseline results and the variation between individuals were higher for all the measured parameters. Nevertheless it was still possible to detect a significantly higher excretion of urinary calcium and magnesium and a decreased urinary potassium after the flavored drink compared with the values after water.

To exclude the possibility that the higher quantities of sodium and magnesium excreted after the carbohydrates could have been due to significant amounts of these materials in the beverage laboratory analyses for these and the other electrolytes were carried out. The results of these analyses and those of the sugar content are in Table 3. The quantity of sugar ingested from the flavored state and the sugar based drinks was similar at about 6000 grams and it can be seen that the mineral intake was insufficient to account for the increased renal output even if it were assumed that all the mineral was immediately absorbed by the gut and excreted by the kidney.



Table 1

The mean, standard errors and the mean percentages of the indicated constituents per mass per 10<sup>3</sup> percent before and after diagenesis. 100% of either decomposed matter, solid or liquid. Results are based on the values for 8 runs of each parent.

Parameter	10 <sup>3</sup> before solid and liquid	Flow	20 <sup>3</sup> intervals after solid and liquid				Total 2 flow output
			1	2	3	4	
Volume ml./mass/10 <sup>3</sup>	40 42 134	Water Cells None	40 38 24	105 112 200	151 152 183	53 108 53	443 423 439
Calcium mmol./mass/10 <sup>3</sup>	19 24 119	Water Cells None	18 17 12	15 27 34	89 98 53	18 15 25	0.51 1.08 1.09
Phosphorus mmol./mass/10 <sup>3</sup>	10 10 14	Water Cells None	10 10 15	11 31 21	88 23 12	27 18 20	0.50 0.50 0.53
Ca/Mg	1.4 1.6 1.4	Water Cells None	1.3 1.7 1.3	1.0 1.2 1.3	1.0 1.5 1.2	1.4 1.4 1.5	1.3 1.6 1.3
Calcium mmol./mass/10 <sup>3</sup>	1.0 1.2 1.4	Water Cells None	2.0 4.1 2.5	1.4 1.7 1.7	1.0 1.3 1.4	1.7 2.9 2.3	3.8 10.0 8.0
Phosphorus mmol./mass/10 <sup>3</sup>	1.1 1.2 1.3	Water Cells None	2.7 2.4 2.3	2.3 1.9 1.6	2.9 1.7 1.0	2.1 1.0 1.1	12.8 7.5 8.1
Phosphorus (mmol./mass/10 <sup>3</sup> ) mmol./mass/10 <sup>3</sup>	1.40 0.80 1.12	Water Cells None	1.10 0.80 0.75	30 40 1.40	1.10 79 44	1.10 64 1.12	1.10 1.10 1.10
Mass and solid mass mmol./mass/10 <sup>3</sup>	1.00 1.00 1.00	Water Cells None	1.11 0.70 0.71	1.11 1.43 1.10	1.11 1.12 1.40	1.11 0.11 1.00	2.10 2.10 2.10
Calcium and solid mass mmol./mass/10 <sup>3</sup>	44 48 73	Water Cells None	47 45 74	54 1.16 42	42 86 42	1.12 84 47	1.10 1.10 1.10
Calcium and solid mass mmol./mass/10 <sup>3</sup>	27 28 11	Water Cells None	1.10 1.10 11	1.10 1.10 11	1.10 1.10 11	1.10 1.10 11	1.10 1.10 1.10

Table 1

The mean urinary volume and the mean composition of the collected urine (mean per cow per 30' period before and after drinking 200 ml of either demineralized water or flavoured diluted syrup in the feeding or non-feeding state) (means based on values for each cow at each point)

## (1) WATER

Parameter	30' before initial 200 ml water	Flowed	30' afterwards when 200 ml flowed				Total 2 hour excretion
			1	2	3	4	
Volume ml/min/30'	11 13	Water 200 drink	31 45	123 175	161 181	58 58	315 464
Calcium mmol/min/30'	.08 .05	Water 200 drink	.23 13	.05 15	.25 17	.05 14	0.18 0.55
Magnesium mmol/min/30'	.05 .05	Water 200 drink	.07 15	.06 11	.04 14	.05 13	0.22 0.43
Cu/kg	0.9 1.1	Water 200 drink	1.0 1.0	0.8 0.4	0.5 1.1	0.4 1.1	0.8 3.6
Sodium mmol/min/30'	1.0 1.4	Water 200 drink	1.7 5.4	3.4 3.3	1.6 3.0	1.3 2.7	7.0 13.5
Potassium mmol/min/30'	0.7 0.9	Water 200 drink	1.0 1.1	1.7 1.0	1.6 1.4	1.3 1.1	5.6 4.7
Phosphorus, inorganic mmol/min/30'	0.05 0.21	Water 200 drink	0.05 1.05	0.04 1.15	0.05 0.19	0.05 0.07	0.23 3.61
Net acid excretion mmol/min/30'	1.81 1.71	Water 200 drink	1.55 2.40	3.75 3.11	1.45 1.55	0.99 2.06	7.75 7.71
Excreted acid mmol/min/30'	31 35	Water 200 drink	17 10	31 63	33 44	31 63	1.33 1.65
Uric acid mmol/min/30'	.05 .05	Water 200 drink	.07 .07	.08 15	.08 14	.06 16	0.30 0.54

Since the volume of water was the same in both these studies the overall average results of the urine analyses are combined in Figure 1 to compare the mean changes in the composition of the urine following the different stimuli.

The results of the third of these studies in which the urine composition of non-prime

steerformers was compared with data obtained mainly after a priming drink of 1 liter of water followed by 1 liter of Hyral is illustrated in Figure 2. The diuresis effect of primer and Hyral was similar in both groups, all were 11, was the distribution of urinary calcium and magnesium after the primer and the increase in the output of

TABLE 1. CONTINUED

Parameter	20° control 1-18/10 200 mg water	Plant	20° treatment after 120 ml. food				Total 1 hour average
			1	2	3	4	
Glucose mg./gram/20°	40 44	Water COO drink	72 85	170 180	134 75	10 14	231 200
Glucose mg./gram/20°	13 14	Water COO drink	15 14	26 112	29 15	21 11	8.46 8.38
Acetone mg./gram/20°	10 12	Water COO drink	105 15	98 18	101 110	24 19	2.44 2.42
Acid mg.	1.4 1.2	Water COO drink	1.3 1.4	1.1 1.2	1.2 1.5	1.1 1.2	1.4 1.3
Acid mg./gram/20°	0.1 0.2	Water COO drink	0.3 0.1	0.1 0.3	0.2 0.3	0.2 0.3	28.9 19.4
Free amino mg./gram/20°	0.4 0.2	Water COO drink	0.8 0.8	0.4 0.5	0.1 0.5	0.2 0.2	18.0 2.2
Free amino mg./gram/20°	1.25 1.17	Water COO drink	1.81 1.71	0.52 0.03	1.15 1.13	1.70 1.13	5.43 3.97
Net total amino acid mg./gram/20°	0.68 0.26	Water COO drink	0.34 0.64	0.32 0.47	0.56 0.27	0.72 0.7	8.46 11.15
Glucose acid mg./gram/20°	17 75	Water COO drink	84 71	46 59	52 56	70 63	2.8 5.59
Glucose acid mg./gram/20°	10 13	Water COO drink	15 24	18 14	15 15	11 11	8.46 4.9

there was after the restricted drink. The total and overall increases of carbon in the metamorph was significantly higher than the controls (p < 0.01) but there was no difference in nitrogen reaction between the two groups. There was a significant dominance in urinary potassium excretion in both metamorphs and controls after the restricted drink (p < 0.01) but the apparently greater fall in the metamorphs was not statistically significant. Overall there was no change in urinary sodium or phosphate

excretion after food. Because of the wide variation within both these relatively small groups of men it was not possible to detect any differences between metamorphs and controls in response to the single dose of Hypod.

#### Discussion

It is now widely accepted that various nutrients both protein and carbohydrate can release both the potential phosphorus and the energy sources of carbon and

TABLE 3

The quantities of sugar and minerals ingested in the rationed drink

	Control diet	Diet	Breaks made from orange (as consumed)			
			Orange	Sugar	Ascorbic acid	Water
Available carbohydrate as monosaccharides (g)	10	57	10	10	3	48
Calcium (mmol)	1.2	34	57	26	39	24
Magnesium (mmol)	2.5	41	54	30	24	33
Sodium (mmol)	1.6	27	21	11	9.1	1.8
Potassium (mmol)	1.2	33	50	33	55	33
Phosphorus (mmol)	2.4	3.3	3.4	1.9	3.4	1.6

magnesium (Marford and Blackburn *in press*) found that the intestinal absorption of calcium  $\text{Cl}$  was significantly enhanced when 100 grams of sugar was added to the calcium carrier which suggested that a similar enhancement of absorption of dietary calcium might follow the simultaneous ingestion of sugar as sugar containing drinks. Hodgkinson and Hinton (1965) thought that the increased renal excretion of calcium and magnesium after a meal was due partly to their increased absorption and also to an increased glomerular filtration rate caused by the carbohydrate fraction of the food.

Leiberman *et al* (1967) showed that intravenous glucose could induce an increase in urinary calcium and magnesium excretion as effect on the nephron which did not depend on absorption processes. The same workers noted that calcium excretion was increased relative to magnesium and that there was a corresponding decrease in urinary potassium. Increased glucose uptake and glycolysis was

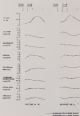


FIG. 1. Relationship between urinary excretion and plasma concentration of a range of substances.

observed in renal tubular cells at the same time. They advanced the hypothesis, which was later supported by the work of Lemann et al (1970), that this increased metabolic activity of the distal tubule in some way enhanced calcium and magnesium reabsorption and put an onus on excretion.

In addition to confirming the effect of dietary sugar in increasing the urinary excretion of calcium and magnesium, the present study has investigated the behavior of sodium, potassium, uric acid, magnesium, phosphorus and urea acid. On these, sodium and potassium by competing in the distal tubule, and uric acid by its chelating effect, could interfere with calcium sulfate crystallization. Their reduction in the urine might therefore be important in calcium

sulfate crystallization, and low urinary levels of sodium (Mullins 1969), potassium (Weidmann and McGowan 1971) and urea (Elliot and Roberts 1972) have been reported. The role of pyrophosphates in increasing the solubility of calcium sulfate is acknowledged so that any tendency towards reduction in urinary phosphate may promote calcium sulfate crystal formation. These studies now reported have shown significant falls in urinary potassium and either no change or slight reductions in urinary sodium, uric acid and magnesium phosphorus following the initiation of a sweetened drink, but the overall effect may nevertheless be mitigated by the marked increase in calcium concentration.

Robinson (1977) points out that hypercalcaemia merely increases the risk of stone formation by maintaining supersaturation closer to the formation product of calcium sulfate and the chemical precipitation of calcium crystals from solution may depend more on variation in urinary concentrations and specific crystal substrates which have been identified in the stone polysaccharide fraction. The relative reduction of less specific inhibitors such as sodium potassium and phosphorus may contribute by a summation effect of a time of increased calcium excretion leading to oversaturation and calcium sulfate crystal formation.

Although the results reported here are crude effects with a maximum response occurring between 3-4 hours since the ingestion of the sugar drink, it is clear that the time during which the stone is at a risk, even well dependent the frequency and quantity of sugar and may also depend on the form in which it is taken. Observations on young subjects living in an environment of chloride-sugared, that their intake of both calcium and sugar rich foods is high even though they do not have their usual access to sweets and chocolate. Notwithstanding



Fig. 1. Percentage change in urinary excretion of the major electrolytes, calcium, sugar, potassium, urea and uric acid.

the wide variation in urinary calcium excretion between individuals and in the same person from day to day (Mortin, 1970) or below the daily output of this group to be higher than that reported for many other normal groups and this may well be due to the high sugar content as well as the high calcium content of their diet.

The effect of increased ingestion of refined carbohydrates on quantity is undergoing evaluation in further studies and in particular the influence of such a dietary regimen on dietary sodium absorption and overall excretion will be important.

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#### PRICES

The situation of all average priced offices in the year to 1969 is given in Table 1; and Table 2 gives the situation for the year to 1969 the Royal Naval Medical Service and the Royal Naval Medical Force.

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## Principal Components Analysis: A Diagnostic Aid in Nuclear Medicine

A. S. Houston

### ABSTRACT

*An attempt is made to describe the use of pattern recognition techniques in nuclear medicine in terms which are palatable to the lay medical audience. The emphasis is on such techniques: principal components analysis, as a diagnostic aid, as a diagnostic aid in nuclear medicine.*

### Introduction

The use of pattern recognition in medicine generally involves one of two requests from the clinician. The first is that of decisions when faced with the fairly high level mathematics which are necessary to produce the desired effect. The second is that of presenting knowledge, a decision-making computer which it is felt should never be allowed to override the doctor's clinical judgment. The aim of this paper is to demonstrate that, while complicated mathematics may be necessary, the concepts of principal components analysis, as the particular technique discussed here is called, are fairly simple and further that much can may be made of the results if they are considered as an aid in clinical diagnosis rather than as a threat.

To demonstrate the kind of problem involved, it is worth considering a simple geometrical problem. Suppose we have a series of observations which consist of two measured quantities  $x$  and  $y$ . Then, for example, could be two measurements of the same parameter at two well defined times; if these are plotted (Fig. 1) with axes OX, Y, it can be seen that by noting these axes in OX, Y, almost all of the information will be contained in the  $x$  parameter. Since axes

will be involved in the original measurements, it would be reasonable to assume  $y$ . We have then reduced the dimensionality of the problem from two to one.

It will now be seen how this concept can be applied to activity-time curves and images obtained in nuclear medicine.

### Method and Applications

When a patient enters a linked to a computer it modifies the performance of two different types of study. Firstly, sample static images of organs may be collected by the computer, as well as an X-ray film and polaroid, and may be processed and displayed in many ways (Houston 1971a, 1971b). Secondly, data may be collected and formed into several frames each representing a different time interval. These can be summed to form a composite image on which regions of interest may be drawn round the relevant organs. Activity-time curves, which are a plot of counts/frame within the region against frame number, may then be formed. This is referred to as a dynamic study.

The application of principal components analysis to dynamic studies is conceptually the simpler, but is only applicable to a series of curves which have been sampled at similar intervals. The main curve is first formed and subtracted from each curve in the series then leaving a new series. The question is then asked: 'What single shape of curve best represents the new series?' i.e. what curve (hereafter called a vector),

when multiplied by an appropriate coefficient  $\phi$  a specific number and added to each individual curve gives a test result  $t_i$  where  $t_i$  may be defined by some criterion such as least-squares. The coefficients thus found will then represent the corresponding original curves reducing the dimensionality from the number of points at each curve to one. The  $t_i$  obtained for each of the original curves may be found by multiplying the vector by the appropriate coefficient and adding the mean curve.

It is clear that there will be very few cases where a single set of coefficients will be sufficient to represent a series of curves. However, by subtracting the fitted curve from each curve in the series a new series of curves will be formed and the process may be repeated. It can then be continued until the experimenter is satisfied that he has sufficient coefficients.

The question then arises when to stop. This decision may be made in one of several ways. Each time a new curve is formed and the dimensionality increased by one, the percentage of the total variance within the sample which has been preserved as dimension reduction may be calculated. Sometimes this will increase fairly steadily initially and then level off when a certain dimension is reached. This would then be a suitable point to terminate. Also, it may be possible to show that at a certain dimension the overall error (using some  $\phi$ ) of the curve either as would be expected due to experimental error, or third method is to demonstrate that the inclusion of an extra dimension reduces an significant measure of diagnostic information e.g. in Fig. 1, the separation of normally normal and abnormal patients obtained using only  $x$  is not improved by plotting the points in two dimensions.

Once an initial study i.e. the formation of a training set has been completed it is possible to use the vectors for classification



of further studies by merely computing the test  $t_i$  coefficients on each case and comparing with those found for the training set.

In the Department of Nuclear Medicine, Royal Naval Hospital, Haslar, we have found principal components analysis particularly useful as an aid to the classification of renal dynamic studies using  $^{99m}\text{Tc-DTPA}$  (Houston, 1976; Houston, Macleod and Sampson, 1976).

Fifty frames of 30 seconds each are formed. Regions of interest define renal, the kidneys and velocity/area curves formed (Fig. 2). From a series of 200 patients (400 kidneys) the mean curve and first three components (Figs 3 and 4) were shown to reasonably represent the curves which had first been normalised so that the maximum count value was always 100 per cent. Each kidney was then classified, usually into one of four categories:

- (A) normal;
- (B) renal artery stenosis;
- (C) paraneoplastic disease;
- (D) solitary tract obstruction.

Although only one initial classification was used in the study it was considered valid to specify an alternative class in certain instances e.g. in the case of a patient with severe solitary tract obstruction with some degree of paraneoplastic damage the classification would be BpC. This was useful for studying regions of overlap in the final analysis.





Fig. 2. Separation of components (class) into two of interest and complementary (control) test objects.

Typical examples of classes A, C and D are shown, together with the line obtained in figs 5, 6 and 7. Only one example of class B was found and as there was some pathological damage and urinary tract obstruction present it could not be considered typical of its class.

The separation obtained when the coefficients are plotted is shown in figs 5 and 6, again from regions of overlap, where in most cases a second class had been designated the classes are fairly well separated in at least one of the figures. Most of the anomalies which appear can be explained fairly easily (Houston, 1971a).





It was further shown that the separation between normal and abnormal latencies obtained using only the first coefficient was better than that using the calculated mean (area) from found by the method of decomposition (Osby, Hall and Curfraid 1976).

The set of vectors and coefficients forms

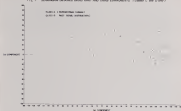
the training set, which is now used as a diagnostic set for all latencies measured at the department.

Other uses of principal component analysis have included the study of pain coping (Barber *et al* 1976) and liver dynamic studies (Rimston and MacLeod 1976). Schneider *et al* (1976) used a similar

FIGURE 1. Separation of normal and abnormal latencies.



FIG. 4. DYNAMIC/STATIONARY IMAGE PAIR: LEFT AND RIGHT EYE PROFILES (70°) (Plane C and D only).

TABLE 1. SUBJECTS (NORMAL)  
(NORMAL) (ABNORMAL)

technique. Factor analysis, in simple classification of IP-differences and nasal shapes. In all cases good class separation was obtained. De Paolo et al (1974) has also demonstrated the use of factor analysis for dynamic studies.

Positive extraction has also been used in static imaging. A static image is stored in the computer as a two-dimensional array consisting of individual cells which contain the relevant counts. In order to analyze six images it is necessary that, as a series of images of an organ, the same cell corresponds to the same part of the organ. These cells are then treated as a similar fashion to the sampled values on the waveform/time curves. However abnormalities in a static image are often small and there are frequently fairly large normal variations. Because of this Barber (1974) used principal components analysis to form a training set of only normal brain

scintigrams. When a brain is routinely monitored a test set can be obtained from the training set which hopefully will represent the normal normal brain. Any abnormality should then appear after subtraction of the "normal normal" and statistical significance may then be tested. The main problem is that of alignment and size. Some pre-processing is necessary to standardize these parameters. Barber and Shariff (1975) have recently extended the technique to liver static studies.

De Paolo et al (1975) and Ishiyama and Rusek (1975) have used factor analysis for scintigraphic image processing.

#### Discussion

One of the main criticisms of pattern recognition in medicine is that it does not advance physiological and patho-physiological concepts (Birkbe et al,



## The Effect of Hypercapnia on Ventilation in Nuclear Submariners

W. M. Edmondstone

### ABSTRACT

Ventilation depths were performed on 17 subjects during a period on a nuclear submarine. Records of carbon dioxide ( $\text{CO}_2$ ) flow rate, inspired and expired air rates, respiratory volume volume (RVV) in l/min were taken during the first 24 hours after the submarine dive. There was an increase in the breathing rate.

After 24 days (16) had no significant response to a mean end-tidal  $\text{CO}_2$  level of 3.45 mm Hg. Hypercapnic response significantly increased ventilation. Adaptation responses to hypoxia were

### Introduction

Of all the aspects of the environment of the nuclear submarine on submerged patrol, hypercapnia is the most abnormal. Crew members are for prolonged periods exposed to  $\text{CO}_2$  levels of between 2.50 and 3.10 mm Hg (0.3-4.5 per cent). Schwartz (1961) suggested that the respiratory system suffered at these levels would remain uncompensated. The present investigations studied ventilation in subjects exposed to the hypercapnia of the submerged nuclear submarine. It sought firstly to assess the effects of the hypercapnia on the rate and depth of breathing. The second objective was to determine whether or not adaptation takes place and, if it does, to see how long the process takes. Finally the response to hypercapnia of men undertaking their first patrol was compared with that of submariners with previous experience.

### Methods

Twenty seven fit young men took part in the study. Of these, 11 had no previous submarine experience (Group 1) and no history of exposure to hypercapnia. The

remaining 16 submariners (Group 2) had previous patrol experience but had not been in sea within the previous three months. During the control measurements undertaken to calibrate the apparatus, a further six volunteers took part.

A 'Waters' canister filled with soda lime was used as a  $\text{CO}_2$  absorber unit. A second canister was filled with olive oil so that the airflow resistance through both units was equal. This was verified by comparing the volume of air passed through each canister in a given time. The two canisters communicated with a manometer through a sliding piston valve. A Wright spirometer and an expiratory valve were incorporated into the apparatus in such a way that the total volume was measured (Fig 1). Each subject inspired water and/or air



Fig 1 Diagram of breathing apparatus showing current used to measure flow through olive oil canister.

through the silicon gel container (mean  $\text{CO}_2$  level at each recording 3.80 $\pm$ 0.73 mm Hg) or  $\text{CO}_2$  scrubbed air through the soda lime. The effectiveness of the soda lime unit was confirmed by weekly probe puncture of the rubber connecting tubing proximal to the container. Infra red analysis of the post-soda lime air demonstrated no  $\text{CO}_2$ . Fresh chemicals were used in the canisters at each session. Their effectiveness was ensured by using British Oxygen Company 'Calcoide' which changes colour on exposure to  $\text{CO}_2$ .

Before diving ventilation studies were performed on 31 subjects breathing compressed air which was being circulated through the submarine. These control measurements demonstrated no difference in RMV between the soda lime and silicon gel units, indicating that the importance of each was the same. The investigation was repeated on 27 men one full day after the submarine had dived, when usually rising  $\text{CO}_2$  levels of 5.83 $\pm$ 0.7 mmHg had been obtained. It was performed again after seven days (24 hours) and repeated after 16 days (24 hours). An interim study involving 17 subjects was made three days (72 hours) after diving. On this occasion Group 1 and Group 2 subdivisions were not differentiated. At each session subjects breathed through the apparatus for five minutes to become acclimatized to it (Fig 2). Measurements of RMV were then made while submarine air was inhaled through the canister containing silicon gel (SG1) after five minutes operation of the prime valve led to air being drawn through the  $\text{CO}_2$  absorption unit and the measurements were repeated (SL1). Five minutes later scrubbed submarine air was inhaled and RMV was measured for a final five minutes (SG2). During the first session 24 hours after diving the breathing rate was recorded and from the tidal volume calculated.

#### Results

The graph (Fig 3) illustrates the



Fig 2. (Continued on over) The prime valve is a 1/2 inch bore unit driven by the rubber diaphragm.

reduction in mean RMV when air was inspired through the soda lime unit (SL1) instead of the silicon gel control (SG1). Reintroduction of hypoxicpress air (SG2) did not elevate the RMV to the levels previously obtained with SG1. This may have been because of a delay in the rise of arterial  $p\text{CO}_2$  or it may have been due to subject fatigue.

The response of ventilation to hypercapnic and  $\text{CO}_2$  scrubbed air was



TABLE 1  
Mean (range) values obtained in 10 subjects during exposure to 5% CO<sub>2</sub>

Parameter	0-15	15-30	30-45	45-60	60-75	75-90	90-105	105-120	120-135	135-150
<b>(1) Control</b>										
Mean $\dot{V}_E$ (l./min.)	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18
Range $\dot{V}_E$ (l./min.)	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86
<b>(2) Group 1</b>										
Mean $\dot{V}_E$ (l./min.)	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18
Range $\dot{V}_E$ (l./min.)	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86
Mean $\dot{V}_E$ (l./min.)	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18
Range $\dot{V}_E$ (l./min.)	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86
<b>(3) Group 2</b>										
Mean $\dot{V}_E$ (l./min.)	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18
Range $\dot{V}_E$ (l./min.)	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86
Mean $\dot{V}_E$ (l./min.)	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18	15.18
Range $\dot{V}_E$ (l./min.)	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86	13.50-16.86

measured by comparing the results obtained using  $\dot{V}_E$  and the mean values of  $\dot{V}_{E1}$  and  $\dot{V}_{E2}$ . Under control conditions using spontaneous air, no significant differences in  $\dot{V}_E$  was found between mean  $\dot{V}_{E1}$  and  $\dot{V}_{E2}$ . After 15 hours, Group 1 subjects demonstrated a reduction in mean  $\dot{V}_E$  of 5.84 per cent when CO<sub>2</sub> was excluded from their inspired air. This compares with a drop of 5.56 per cent, shown by mean  $\dot{V}_E$  in Group 2. When the increase in  $\dot{V}_E$  on initial exposure to hypercapnia was due entirely to mixed tidal volume it is confirmed by the fact that the breathing rate did not alter.

After the subjects had been denied for one week (168 hours) subjects in Group 1 demonstrated a 5.56 per cent drop in  $\dot{V}_E$  on removal from the CO<sub>2</sub> stimulus. Group 2 subjects on the other hand, showed only a 3.34 per cent reduction. This difference in response between the two groups is not however statistically significant (Mann-Whitney rank test) and does not indicate that the men with previous partial exposure adapted to hypercapnia more rapidly than the others.

After 15 days (360 hours) no significant reduction in  $\dot{V}_E$  could be detected in

either group when CO<sub>2</sub> was removed from inspired air. Respiratory adaptation took place therefore before the subjects had been exposed to hypercapnia for 15 days. The results are displayed in Table 1. Figure 4 demonstrates the reduction in hypercapnic induced hypoventilation with increasing duration of exposure.



Fig. 4. Reduction of hypercapnic induced hypoventilation after prolonged exposure to hypercapnia.

### Discussion

This study illustrates some of the pitfalls of attempting to conduct scientific experiments in an operational situation. The lack of space on a submarine, for instance, restricts the explanation of any apparent to be used. The equipment employed here, however, was simple compact and robust. It was not flawless. Both flow meters on the oxygen system with  $\text{CO}_2$  and may therefore worth inspecting our flow gas, on the other hand, has a damping effect and to reduce the humidity of inspired air. These factors, however, would have influenced the results by the same degree at each session and so would not have affected the overall trend. Moreover, control measurements failed to demonstrate any difference in RMV between the two units and the subjects themselves reported no difference in the quality of the inspired air.

Despite its limitations, this study conducted as it was in field conditions, succeeded in answering the questions raised by the investigators. Firstly it confirmed that the hypercapnia in nuclear submarines does stimulate ventilation. It does this by increasing the tidal volume and the respiratory rate. Secondly, after a period of time, adaptation to hypercapnia does occur. Finally, it seems that previous exposure to hypercapnia does not influence the ventilatory response to it if the exposure took place three months before. Fig. 3 demonstrates that although both groups responded to hypercapnia in the same way, Group 2 subjects had higher absolute RMV values. This is probably because the subjects in this group were not only older but heavier and heavier.

The results obtained are broadly similar to those recorded by Garvin *et al.* (1976). At 7.60 mm Hg  $\text{CO}_2$ , they found a maximum increase in ventilation of 13 per cent over baseline levels but this did not occur until the fifth day of exposure. They attributed

this to the 'gradual' increase in the body load of acid. They also noted a gradual reduction in ventilation during the exposure period and after 20 days, control levels had been achieved.

The higher  $\text{CO}_2$  levels in the present study may account for the more rapid adaptation time. In his account of triple saturation limits to  $\text{CO}_2$ , Schaefer (1964) suggested that the adaptation time was inversely proportional to the degree of hypercapnia. However, he declared that any adaptation occurred at levels below 6.25 mm Hg. In 1963 Schaefer *et al.* exposed 21 subjects to a  $\text{CO}_2$  load of 11.50 mm Hg for 43 days. He found a 26 per cent increase in RMV which was maintained throughout the period of exposure. The hypoventilation continued until fresh air was introduced when RMV fell dramatically. However, Schaefer concluded that a slight reduction in RMV which occurred between 24 and 42 days exposure represented respiratory adaptation.

Rachumawati *et al.* (1976) noted that respiratory adaptation to a  $\text{pCO}_2$  of 14 mm Hg occurred within 15 days in a group of volunteers. The same authors exposed subjects to 21 mm Hg  $\text{CO}_2$  (1972) and 26 and 32 mm Hg (1973) for the earlier study they recorded stimulation of the hypercapnia induced hyperventilation after only 24 hours exposure. Their findings were similar at the higher  $\text{CO}_2$  levels. However, they discovered that renal compensation for the respiratory alkalosis took eight days at 26 mm Hg, but was complete after only 24 hours exposure to the higher levels.

Reduction of the arterial  $\text{pCO}_2$  by increased renal excretion of bicarbonate is one of the responses to hypercapnia. A second response is the upregulation of  $\text{CO}_2$  receptors. This study demonstrates the development of respiratory centre sensitivity to  $\text{CO}_2$  after prolonged exposure to hypercapnia. This adaptation is a phenomenon seen clinically in states of





## Elevation of Hand and Forearm Injuries — A Useful Sling

C. Chapman

Injuries, infections and burns of the hand are common at sea. The elevation of limbs in affected and also of hands following routine surgery has long been accepted as an essential part of the routine treatment of these patients. A number of methods have been used to achieve this: many of them improved, using roller towels or sheets.

The sling described here is easily made, adjustable and reusable, being constructed from cotton duck in the pattern shown (Fig. 1). The bottom part of the sling



on which the upper arm will rest is lined with 4 inch Bantex. This is a foam with adhesive on one side which will adhere to the cotton duck and so maintain its position. The Bantex is removed from the sling (in parts all ready) before the latter is used as the bandage and later replaced with a new piece of Bantex.

The limb is placed in the sling and prevented from falling back onto the patient when he (or she) is asleep by a large

safety pin — 1 cm one of the other large pins that were once used to keep away leopards on groups of ten. The pin is inserted through the sling when the limb is in position. The sling is suspended from the cot sheet (or any or from a drip stand (askew) by cord through the 'break cycle' (Fig. 2).



The great advantage of the sling, apart from the fact that it is more comfortable for the patient than improved designs, is that the patient's fingers are easily seen and kept resting in line disturbance of the patient's angle — or still be small thing.

A smaller sling with dimensions A-B reduced is used for children (Fig. 3). All the materials required are held in stock by the author, who can produce the sling within the hour.

## Unusual Job for a Naval Medical Officer

L. F. Spens



Millions of people have now crossed the Atlantic by air but perhaps the shortest despatch of a wartime passage from Bermuda to Newfoundland and then across the Atlantic to Canada may be all some created.

In July 1941 I was the operations specialist and Principal Medical Officer of the Dispatch to Bermuda and was due to return home to join the battle cruiser *Anson*. There was, of course, an urgent demand for aircraft for Britain and under the famous *British Fleet Air*, the United States of America was to supply a great number. No ordinary passenger or cargo were allowed on these makeshift trips, but if during their short stop in Bermuda a situation was eligible to release one of the personnel for further flying duties, so much the better. I applied to do this and was duly accepted to relieve one of the engine fitters and told to be ready for an early start.

A few days later I was telephoned one evening and told the aircraft had arrived and I was expected to be on board early the

next morning when a trial flight was to take place and I would have undertaken it my new duties.

On arrival at the harbour next morning I thought I had never before seen such a magnificent looking aircraft — a large four-engine amphibious flying boat, long actually as two motorships. She was based now from the United States factory and now came under the Ministry of Aircraft Production. No comment was needed for this was to be fitted in the U.R. 4 and when we got there.

There was a very cheerful and pleasant mixed crew consisting of a Squadron Leader of the R.A.F. in command and an American civilian copilot. The navigator was a Pilot Officer of the Royal Canadian Air Force and there were two American wireless operators and two engine fitters, one of whom I was to relieve — a new role for myself!

Flight trials were carried out for two hours during which time I was shown all the layout of the many dials and switches of the two 1200 hp Pratt and Whitney engines and how and when to log the various readings and how to make any necessary adjustments e.g. regulating the cylinder head temperature, checking the petrol consumption etc. etc.

The engineers' compartment was quite comfortable, high up in the hull under the wing between the two engines. One had a good view through the window on either side, but not round ahead as the space was

completely occupied by instrument trays and dishes. A small table and a chair completed the furniture.

The meals were excellent and after-landing we went ashore to try on our cold-weather gear which consisted of a one piece fur coat, trousers and boots. In spite of eye apparatuses that was not funny in the subzero weather.

It was arranged that we should leave the next day and about 0600 that morning the crew, which were officially included myself, were making a hearty breakfast in the rather luxurious Belmont Manor Hotel. A vast quantity of stores, equipment and other mail and provisions were embarked and I said goodbye to my family whom I was not to see again for over two years. We were so heavily laden that it took us quite a long time before we could take off from the Great Island of Bermuda Harbour.

I did our two hour watches alternating with the engine crew and eight hours later we were over the forest and hills of Newfoundland and eventually came to rest on the long Lake Charles where we landed in a bay. A motor boat promptly took us ashore where a small boat transported us through quiet forest country to the little Canadian Pacific Railway Hotel where we were to stay the night. After an excellent dinner, all the crew went for a short walk and then turned in early. I slept the clock round and did not wake until lunch time. Some after lunch the wren of us decided to have a walk in the road leading us but after a short stroll the Squadron Leader said, as what I thought was a rather condescending manner, 'Come on, chaps — let's go and we want a bus and motor boat were hurriedly called into action. The aircraft had already been re-fuelled and we took on the long hike and finally took off with our

exceptionally heavy load.

For several hours we flew at 5,000 feet. Coffee and an excellent assortment of sandwiches and fruit were available at intervals arranged for us. I kept my two hour watches in the engineers' cabin, keeping the logs and making the required calculations and found the whole situation most absorbing.

When all I think I could do in terms of the four hours and on some occasions of the co-pilot left his seat. I could sit there and talk to the captain, at all other times the navigator would discuss some points of aerial navigation.

During one period I noticed a fault connected with fuel consumption. I called up the engine crew who came immediately and found that the flow from one of the petrol tanks was impeded. The captain and the navigator soon followed and the condition was thought to be serious but we had passed the point of no return and therefore had to go on whatever happened. We lost height gradually and I think we must have felt apprehensions but we were after all a flying boat and the sea looked moderately calm. Fortunately some minutes later the condition was rectified, the indicating dials resumed their normal positions and the steady drone of the engines was heard again so we climbed to the planned height of 5,000 feet.

Thirty hours after leaving New Brunswick, that is 23 hours flying time from Bermuda, we sighted our landfall and then coasted all the way up the Clyde to Greenwich where we ported and went our various ways. After the moment was found the world suddenly became a worthy addition to the Royal Air Force. He it has been noted that the *Cutler* was one of the most successful flying boats ever built.

## Impressions of the Yaman

A. E. Riecke

I was fortunate in being able to spend my two month elective period in the Yaman Arab Republic. It is a remarkable country with a varied landscape ranging from the dry, flat, approximately flat coastal strip bordering the western shore of the Red Sea to rocky volcanic mountainsides and the plateaus at 4000 and 7000 feet which are bare in the dry season but surprisingly luxuriant after the rains.

The country is economically very poor having no natural resources and having only just recovered from a ten year civil war which ended in 1966 when the Imam was overthrown and his son deposed.

The main occupation is agriculture and the people maintain a standard of living slightly above subsistence level by growing wheat, millet and fruit and herding flocks of fat tail sheep.

The people are anthropomorphized in the western sense of the word. Many of their ideas and attitudes are medieval as they have only recently come into contact with western culture, science and technology and are still much influenced by Islamic customs regarding strangers, women, the family and religious life. One custom in particular can give rise to a lot of cultural shock — this is the custom of the women working with so that only the hands and occasionally the forehead and eyes are visible. On one occasion I was helping a doctor with his post-mortem clinic when a patient came in. She was an Arab and wore a veil. The doctor asked her in Arabic what was the matter and she replied in a forced Liverpool accent, "Headache and heartache". This woman had lived at Beirut for fourteen years and had then

returned with her parents and married again. On Arab customs when she married a Yemeni husband.

The main source of wealth of the richer people is the cultivation and sale of khat, an amphetamine like drug which has a stimulant effect on the CNS producing euphoria followed by depression, substantial loss of appetite and then long term habit but one has serious effects upon the cardio-vascular system and the patient's mental state and can also give rise to psychiatric disturbances. It is not a drug which causes irreversible craving but it is socially acceptable in those countries in which it is used and that is able to damage the whole of society rather than just the individual and his immediate associates as is the case with amphetamine abuse in western society. In fact of spread outside the Arab (Islamic) world is thought to be due to the fact that the leaders of the Arab (Islamic) are strict just not where khat.

I spent my time in the Yaman at Khat Hospital which is owned by the government. It is run by a Council of four Arab medical men which provided the administration and doctor and dispenser and three nurses. In addition there were two other nurses, one Danish and one English, two Russian trained Yemeni doctors and seven Yemeni x-ray operators.

It is a very small hospital with three wards each with a maximum of six beds so that the total number of in-patients is twelve male and twelve female. However the hospital was always crowded because anything up to four relatives would come along to look after and feed each patient.

The standard of hygiene in the wards was very low despite the strenuous efforts of the staff. Food was often left lying around and there was an abundance of flies and toad spawners, and especially around the feet of the children. There was no adequate system of waste disposal other than burning. This was rarely carried out efficiently and the dogs lying about outside the hospital were regularly scavenging the messes thrown in search of food.

My purpose at the hospital was two fold: firstly to carry out a small ophthalmic survey of 100 people attending the outpatient department and secondly to assist in so far as possible in the hospital.

The results of the survey are not remarkable, mainly because the numbers were too small to be able to compare them properly with other surveys. However, the main points noted were that there was very little trachoma in the country which I think is due to the fact that the main strands in 7000 feet and the rainfall together with the coastal and desert areas, resulting in fewer flies and perhaps less exposure. Most of the lesions in the eyes were due to exposure to dust, sun and wind with many people having ptosis (Fig 1).



Fig. 1 Ptosis.

Most of the work of the hospital was done at the outpatient clinics held every morning

between 8.30 and 1300. Often as many as 200 patients would be seen in one morning by the three doctors. As they also had to deal with all emergency and casualty work they started the pace considerably if it occurred in the morning. My time in casualty covered a great deal of work involving minor surgery or extracting fragments of bullets from limbs, setting fractures, stitching up lacerated wounds and other more usual minor injuries.

X rays were taken and developed by the doctors, and once I had learned the techniques this task was allotted to me. I had never realised what an art it is to take and develop a good X ray. It was a most interesting experience but involved a good deal of guesswork and took in the early stages.

The range of problems presenting at the clinic was wide. The commonest were tuberculosis, infections, trachoma, malignancies, orthopaedic problems and trauma. Hearing difficulties, cataracts and malocclusion (Fig 2).



Fig. 2 In patient consultation to determine dental status.

The casualty work continued into the afternoon when elective operations were carried out. On occasions when major surgery was carried out I was responsible for the anaesthesia — either after chloroform induction.

The women can attend health and antenatal clinics on Friday afternoons. There had only recently been started and there who used them tended to be women who had been in hospital for other reasons and consequently knew and trusted the staff, or women whose husbands had been to UK or USA and, appreciating the advantages of a health service, had persuaded their wives to attend the clinics.

There are many problems in providing a medical service in a country which was only opened up to the outside world two years

ago, after centuries of isolation, and it is easy to feel frustrated, when one sees people disabled or dying because of the lack of specialist skills or the money to buy equipment and medicines. However, unless these limitations the medical professionals achieve a great deal, not least in the areas of health education, vaccination and ante-natal and children's clinics.

Altogether I very much enjoyed my visit to the Yemen and I will value it as an experience of another country and of a developing health service.

#### **SURGEON REAR ADMIRAL A DYCKHOFF, MBE, RE VISITS THE ROYAL NAVY**



*With the headmistress of West Australian  
Nursing School*

*The cheerful group about Surgeon Rear Admiral G Gausser, Deputy Director of the Blood Transfusion Service of the Australian Red Cross Society, with Surgeon Commander Derek Day on the occasion of*

*DMB Egger's visit to Perth, Australia. The Admiral found the ship's company in the generous and cheerful blood donors they also donated blood to the Turkish Red Crescent.*

## HMS SALISBURY



*This painting of HMS Salisbury was most generously presented to the Institute of Naval Medicine by Surgeon Vice Admiral Sir James Ware at a reception held at the Institute on March 17, 1939. The Salisbury was a 58 gun warship in which James Lind introduced the first controlled clinical trial in 1747 which proved that scurvy could be cured by citrus fruits. The artist is J. Peasey.*

Although the Royal Naval Medical Service possesses portraits of most of its distinguished doctors, an important exception was James Lind Esq, thanks to Sir James generously this gap has now been filled (see *Newsquest*).

In addition to carefully recording the two decades' research's diseases, scurvy and typhus, James Lind contributed in many other aspects of naval medicine and has justifiably been called the Father of Naval Medicine.



# LETTERS TO THE EDITOR

Sir,

We enjoyed greatly the article by Surgeon Lieutenant Commander E. T. Jolly in the Spring 1976 issue of the Journal and appreciated an article of practical interest to the Royal Naval Medical Service. We are however much interested in the use of atropine for complete heart block (legend in frontpage) and would appreciate a reference to the authority which recommends the efficacy of such treatment.

We are, etc.

N. R. Eddletham                      J. M. Collins  
Surgeon Lieutenant      Surgeon Lieutenant  
Commander RN                      RM

*A copy of this letter was sent to Surgeon Lieutenant Commander Jolly and his reply is printed below. Ed.*

Sir,

The frontpage photograph was chosen because it was clear, dramatic, and also illustrated a general point made in the article. The two line caption is it could not tell the whole story about that particular incident. However...

On the morning of November 16, 1976 a fishing ship anchored in Mounts Bay after requesting medical help for a crewman who had collapsed with chest pain. The Portsmouth infirmary took three honorary medical officers out to meet it but because of the heavy swell they also took the precaution of informing

Colchester. The RNLI doctor thought the crewman's state too poor to risk moving him to hospital by boat, so the DTG Sea King and MD 440 landed. One a typical Colchester 'clump'. The patient was indeed poor on the RN MD's arrival. The patient had a bradycardia that varied between 40 and 50, and was shocked. In case any other vital time elapsed it was abolished by atropine 0.5 mg after measurement alone had been established. The clinical picture improved immediately so he was then properly prepared, wrapped up and transferred to hospital via Portsmouth Heliport. He subsequently required more cardiac resuscitative pacing before he could be repatriated.

Even if complete heart block is going to be the eventual outcome it is well worth trying the vagolytic effect of atropine to correct a bradycardia in the immediate post infarct period". Of course, atropine's anaesthetic effects have no place in the long term drug management of such a problem because it's the sympathetic system that need stimulating. Or something like reserpine or a derivative for a chronotropic effect. I certainly didn't mean to imply otherwise, and I hope to see the next edition!

I thank Nick Blacklock and Jon Collins for their letter and join, Sir, for the opportunity to reply.

I am, etc.

**Mark Jolly**  
Surgeon Lieutenant Commander RN

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*Ed. We are grateful to the Editor of Public Health for allowing us to reproduce the following letter which first appeared in Public Health (1938) 92, 51-52.*

Sir,

**Overconsumption**

Recent correspondence in your columns reflects the mounting concern in the place of sugar in the diet of man, and indeed, poses the question: Does manufactured sugar have any place at all in a health promoting diet?

You may know that questions of this nature are a prime concern of the McCarrison Society. We are authorized by that Society to draw upon the observations of the Deputy Director-General of the British Sugar Bureau. We feel that this may be most profitably undertaken by replying both to the points raised by Mr. Sumner in his letter in Public Health 91, 313-314 92, 29 and in the pamphlet recently circulated by the British Sugar Bureau among members of the British professions.

It appears to us that the latter publication is misleading and tends to divert attention from the mounting clinical and epidemiological evidence which increasingly affects refined carbohydrate foods as a cause of human disease across a wide range of conditions from simple obesity to arteriosclerosis.

*The action—quantity and place in the diet of sugar.*

*Does not the much sugar?*

The first and most basic criticism of the

Sugar Bureau's pamphlet is that it does not distinguish between refined concentrated sugar produced by manufacturing process, and the sugar that occurs in food in the natural setting. Sugar does not occur in nature in its concentrated form. It is normally found in fruits and vegetables in the bulk of large quantities of vegetable pulp, or fibre, especially in the sugar beet and sugar cane described in the Bureau's folder. To extract this sugar and then to put it in concentration in confection and leads to gross over consumption.

Compare 2 oz. of refined sugar with the same amount of sugar in the natural setting of about a score of concentrated apples. Compare the use in consumption of these two forms of sugar—the concentrated and the natural—and you can doubt which is the more easily consumed, and therefore the more rapidly leads to over consumption.

Naturally-occurring food eaten whole with its natural sugar contains independent variety among food substances of the stomach. Refined sugar produces in such bulk satiety.

The disastrous effects of over consumption have been documented elsewhere.<sup>1</sup> They include the deadly trio of obesity, diabetes and coronary thrombosis—which frequently occur together. Further serious effects from this over consumption take place in the bowel wall, where I<sup>2</sup> Crohn and others recognize problems in the unusual food surplus and there is evident association between high sugar intake and appendicitis, and cryptic cure is prevalent in women. Other consequences due to the lax of slow control of constipation, diverticular disease and the various events of haemorrhoids, varicose veins and deep varicose thrombosis.<sup>3</sup>

*Does sugar promote more serious than any other food?*

Weight for weight, this provides more calories than sugar. There are vital differences however.

In contrast to the dramatic increase in public sugar consumption over the past century, there has been no comparable rise in fat consumption and probably no rise at all.<sup>2</sup> It has certainly been possible over the past 150 years to reduce sugar consumption. By contrast, much of man's fat consumption is a relatively natural food and has been for thousands of years. The keeping of flocks of sheep and herds of cattle for meat and milk started with primitive man.

Furthermore, as the case of fat there is the very real safeguard of the palate. There are few, if any, 'fats' known to be as sugar is consumed whereas the number of individuals who report very well cooked fat on meat is very considerable. Thus the evolved control of taste protects those who by metabolic disposition probably need the protection. In contrast sugar tends to supersede the 'good taste' over the whole lifespan.

Three counterexamples show that the sugar-burners' pre-occupation with calories is really misplaced. Furthermore this is borne out in practice as shown by the fact of the introduction of a high fat reducing diet in the Malvern Hospital.<sup>3</sup>

#### *Sugar and obesity (General)*

Losing resistance in the natural state do not become obese. No rabbit eats too much grass, no fox eats too many rabbits, no carnivorous snake too many fish, no human eats too much plankton. None of them suffers from overweight.

Lack of exercise is not a basic cause of obesity as may be confirmed by observation at any zoo where animals are fed their indigenous diet.

It is the refining of carbohydrates by machinery that removes the real natural pulp or fibre which leads to obesity. The oxidation of refined sugar and, to a lesser extent refined (refined) flour, should therefore eliminate any fattening

properties. These animals seem to be reminded that their well known tendency to obesity is of sugar origin, in the case from the most sugar in the diet. Sources of natural carbohydrates like fruits, vegetables or wholemeal, cereal need not be excluded at all.

#### *Why is sugar accused of providing only empty calories in the diet?*

The phrase 'empty calories' indicates the complete absence of refined sugar of any of the crucially important natural pulp or fibre of all the vitamins, minerals and trace element content of the vegetable. Used in this key sense, the phrase 'empty calories' does indeed epitomise the truth.

#### *Does sugar cause diabetes?*

There is an hour's strong epidemiological evidence that it can, and does. The best example of this concerns the Maori Indians. The consumption of refined sugar in India, 1950<sup>4</sup> would mean that, for India only about 12 lb per head per year, and diabetes has been relatively rare except in the large towns, where about refined sugar is eaten. But amongst the immigrant Indians lately working on the sugar plantations in West Africa, who number about half a million persons, the consumption of refined sugar has risen to over 50 lb per head per year and a veritable epidemic of diabetes has occurred: the incidence of the disease being amongst the highest in the world.

Other examples of the same sequence are to be seen in the Yoruba immigrants for Black Jews into Israel, and consistently with a high consumption of refined sugar is a strikingly high incidence of diabetes in the Cherokee Indians in North Carolina, USA. Also in the Indian subcontinent of Trinidad and in various plantation cities of Polynesia, and even in the Canadian Indians. Smoking references are available on all the epidemiological evidence, and it points to no great a danger for such may it be that there can only be the danger of being ignorant of it.

### *Is sugar-related to coronary heart disease?*

Much of the evidence given earlier under diabetes applies to coronary disease too. Part of all it says is that very many diabetics die of coronary diseases.<sup>1</sup> Thus the Naval Indians suffer largely from it, as well as from the diabetes-dependent cancer. And though coronary disease is practically unknown in the African or Asian world when still living under tribal conditions — which includes the eating of unrefined, not refined, carbohydrates — the closely related Negroes in the United States, living on a modern refined diet of sugar and white flour, get coronary disease just as readily as do the whites.

### *Is sugar directly involved in tooth decay?*

The vast majority of the dental profession believe sugar is the greatest single factor in dental decay: many also believe that the loss of teeth in the milking process is also a powerful promoter of periodontal disease. As Sir Wilfred Fink puts it, the soft, sugary nature of refined foods does not provide sufficient friction to keep the gum margin hard, any more than dental work does a person the hands of a bricklayer. And periodontal disease causes as great a loss of teeth as does dental decay. The dental decay rate through the colonies has kept pace first with the refining of flour and later with the refining of sugar.

As for the American claim that sugar consumed at meal times — or when dissolved in liquids (sweetened drinks) is less dangerous, we should recall that it has been shown that adding sugar to the milk in the dietaries of children, aged 9 months to 3 years can destroy the enamel of the first set of teeth in the course of a few months.<sup>2</sup>

### *Is sugar dangerous in the UK, increasing?*

In spite of any slight fall in the consumption of sugar in the last decade or

two — over the last 250 years there has been a very marked increase in sugar consumption in this country...accompanied by the great increase in its refining by manufacturers. That is also confirmed by Yallian in his work on weighing against sugar.<sup>3</sup>

### *Conclusions*

The British claims that some 15% of our diet comprises manufactured sugar and that other carbohydrates (all of which have a major end-product in carbohydrates) account for at least a further 30%. Accordingly therefore we take particular note with the statement that medical and dietary authorities agree that the proportion of sugar in our diet is quite acceptable. We believe that we express the very real concern of increasing numbers of members of the health professions about the quantity and consumption, in health of manufactured sugar in the diet.

**T. L. Cleave, FRCP**  
Surgeon Captain RN (Retd.)  
and  
The McCarrison Society

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phenomena are means of self-regulation; metabolic effects may involve a specific cellular or chemical adjustment.

Throughout the book there is laid out a clear approach, and the reader is apprised of the problems for solution.

Occasionally isolated days occur, for example 'Cells and Tissue Adaptation to Low Water Activities' but overall it is a valuable introduction.

Recommended for the information file.

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**PHYSICS — A HANDBOOK OF PHYSICAL MEDICAL DATA** (2ND EDITION) Edited by JOHN CANNON (University of London) and JOHN HARRIS (P.O. London) Chapman & Hall, 1970, 312 pp. £2.50.

This is the 2nd and final instalment of the handbook to be followed in regular intervals by updating supplements. This instalment covers a broad spectrum of subjects ranging from the anatomy of the human body, to fluids, a chapter on heat, and measurement. Through the book biological processes are covered but again, primarily as the physical basis of cellular processes. From John HARRIS' excellent contribution on 'The Middle Ear', and also books in covering the various systems. In general it is not so much a matter of pure medical physiology and from Chapter 1 there is little to suggest that this is not merely a reading of the whole book, but a support to the knowledge in the field of physics, rather than in the 'Medical Physics of Computed Tomography and General Physics in Medicine' on the subject of fluids and bioelectricity. The chapter on cell structure and measurement and the other parts is clearly based on broad physical concepts and a good blend of description and analysis. This is primarily a chapter worthy of further reading and analysis.

In summarizing the physics in this book is a whole because I am influenced by the poor presentation of what is particularly in chapters on bioelectricity, a text written by a physicist or physicist, and a knowledge of physics is necessary to understand the physics of the human body. The book is a very good introduction to the physics of the human body, and a good book to read. It is a difficult book to study as it covers the whole of the subject, it is clearly not intended to be a book of reference, but a book of introduction to the subject. It is a book of introduction to the subject, and a book of introduction to the subject.

In the whole book, the author, John HARRIS, states that 'the contribution of physics to the study of the human body is a subject of increasing importance'.

It is this book, written by a physicist, that is a book of introduction to the subject, and a book of introduction to the subject.

of the human body, and it is a book of introduction to the subject, and a book of introduction to the subject.

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**THE UNDERWATER ENVIRONMENT: A GUIDE TO PHYSIOLOGY AND PERFORMANCE** (2ND EDITION) Edited by C. G. MALLORY, MARGARET P. HARRIS, and J. HARRIS. Chapman & Hall, 1970, 312 pp. £2.50.

It is a pleasure to see the authors present their material. The subject is the human body, and the authors are the authors of the book. The book is a book of introduction to the subject, and a book of introduction to the subject.

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**PROMOTIONS**

To Commander and Royal RNS Branch as Director 1,  
RNS A. C. Mackay



*Commander and Royal RNS Branch as Director 1,  
RNS A. C. Mackay. He was promoted to the rank of  
Commander on 1st April 1958 on the expiry of  
his commission.*

To Lieutenant Commander  
J. B. Fraser

To Acting Lieut. Commander  
R. J. Pollock

**RETIREMENTS**

Lieutenant L. Randle  
Lieutenant L. L. Galt

**QUEEN ALEXANDRA'S ROYAL NAVAL  
MEMORIAL SERVICE**

Queen's Birthday Reception, 1958

Royal Naval Corps in Civil  
Frasquerie House Mrs M. B. Collins

Association of the Royal Naval Corps in Civil  
Superintendent Secretariat D. Smith

**PROMOTIONS**

To Superintending Store-  
keeper M. B. Smith & P. Cloughan

**NEW EXETER**

Radio Planning Officer  
Messrs J. D. Hughes & J. M. Smith & Messrs J.  
H. Gifford & Lockwood

**Working Stores**

Messrs L. J. Bayley & Messrs C. M. Paine & Messrs  
G. H. H. & S. H. H. & S. H. H.

**RETIREMENTS**

Messrs J. D. Adams Superintending Officer

**ROYAL NAVAL RESERVE****PROMOTIONS**

To Reserve Lieutenant Commander  
P. J. D. Green P. H. H.

To Reserve Lieutenant (R)  
P. J. H. H. H.

**RETIREMENT**

Reserve Commanders (R) J. H. H. H.

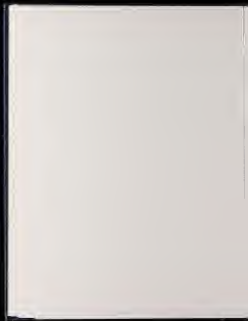
**NOTES OF SERVICE**

The Director General of Service of Reserves was  
appointed to the position of Director General of  
Reserves on 1st April 1958 by the Ministry of  
Defence.



JOURNAL OF THE ROYAL NAVAL MEDICAL SERVICE  
INSTITUTE OF NAVAL MEDICINE  
ALVERSTONE HANTS. POLINA











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## Editorial

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The reason for Armed Forces Medical Services, and the need for separate medical services while the Armed Services remain separate, have been recently admirably restated.<sup>1</sup>

The Naval Medical Service is now the smallest service but its problems of professional deployment, and its needs for professional specialization in disciplines unique to its service, are possibly greater than in either the Army or I&AF.

We face three problems, motivation of personnel, development of their professional skills, and deployment of those skills in a wide and flexible manner to meet our tasks for the Navy.

To understand and care for our service persons a knowledge of the "Andrew" is essential, and there is no substitute for only one service in acquiring the normal understanding and attitude. It becomes one's whole life for a while, and the back ground is a forever afterwards. One acquiesces, then assumed empathy is never lost however long or short one's subsequent service. Indeed many of our friends comment on the medical profession not sharing this attitude, and their professional behavior seems better for it.

Extremely, short time acquiesces this normal motivation: there is little requirement in the "postwar" Navy of today for a medical officer's professional skills in every ship or unit, or every establishment alike. And this is particularly true with a shortage of medical officers to meet our professional tasks.

When ships ranged the world and operated

from overseas bases, ships with crude medical facilities afloat, conditions were different — and young medical manpower was more easily deployed without the penalties on them of missed postgraduate training. The venture was well understood as a well-run rule book. The "float" dealt with the day to day stuff and the medical officer was available to cope as best he could with emergencies and serious cases. In addition to these "pushover professional duties" — unemployed professionally while the team was doing well, and largely helpless against the difficult medical "float" — the medical officer's secondary role was as adviser to his commanding officer, and a useful link in the chain from workroom to deckchairs. But today if we haven't enough medical officers to meet our professional tasks, those tasks must have priority over this useful but auxiliary role.

There are, of course, situations where a medical officer is required despite his being day to day professional tasks — no group deployment, no current, or otherwise, with Mission and helicopters on display most, and as part of a support team, or larger ships — and there can be satisfying appointments with a real professional task, and the auxiliary role is useful and enlightening.

Spread deployment to these situations creates turbulence for medical officers but this is to be preferred — particularly in a shortfall situation — to the ill-considered professional appointments which today neither appeal nor provide an outlet.

practice and training, both ashore and afloat.

There remains the problem of acquiring the essential experience in the Navy which only sea-service can give, but about which establishment in service officers can, in part, inform. And there remains the problem of professional support to the deployed MA — at sea and in establishments. The former can be met by initial shore appointments, when possible, and the latter by further training and improved communications and better management of our experience.

"A common misconception holds that surgeons' messengers, physicians assistants, and other medical auxiliaries are trained to provide a second main service when there is not enough money (or personnel) to provide a first-rate one staffed by fully qualified doctors. The delirium between auxiliaries and professional physicians is that the former are trained to perform a restricted range of clinical duties — and their training stresses continued professional improvement."<sup>1</sup>

The problem for the Navy is to provide this experience for the deployed MA and to train him for an independent though limited role, and at the same time fully utilise the professional skills of the medical officer, most only by doing so on a today record and retain doctors.

The Navy needs good MA's and they are trained initially to SMN and SMN standards. But SMN's and SMN's, though trained to high standards, are trained to perform their professional tasks within a "copy" medical hierarchy with professional medical help immediately available. The unsupported MA requires a greater knowledge, and further training<sup>2</sup> which can be provided, and is provided for this role in the Army and the USN in "para mode"<sup>3</sup> standards. It is an establishment with easy communication to properly manned aviation and emergency, and equipment, experience the required additional experience is not gained. But on sea it results deployment — still in sea —

the task is greater and a professionally demanding one for the MA who should be trained for it and rewarded for his further skills. Extra training has produced the successful "big mader"<sup>4</sup> of the North Sea,<sup>5</sup> and more are recruited from general medical personnel.

The USN, unable to provide medical officers for all its submarines, is exploring computer diagnosis linked to base on the De Donal system.<sup>6</sup> In the Netherlands a well developed system of radio medical advice to merchant ships at sea<sup>7</sup> has been in use for some years. In our Navy we need further training for the para mode and a development of the radio medical advice system whereby at times the MA is linked to a known duty medical officer on a hospital ship. A development of Search and Rescue services and a refinement and extension of the existing system of radio medical advice we provide on demand to the British Merchant Marine would start the work.

On such a basis we could provide a better service with greater professional satisfaction in their jobs for all. And in early benefit from such an approach to motivation, professionalism and deployment could be to stop the decline in recruitment of medical officers and increase their experience, provided proper pay for proper jobs is eventually achieved.

For the 1980's we need more professionalism, not less, in all sections of the Medical Service. We cannot convert the 1970's.

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## Physiotherapy and Manipulation from a Patient's Point of View

*Admiral of the Fleet The Earl Mountbatten of Burma, KG, GCB, OM, DSO, FRC*

I am honoured to have been asked by the Dean of Naval Medicine to contribute an article on the care of injuries by physiotherapy and manipulation from a patient's point of view to the *Journal of the Royal Naval Medical Service*. Not many people can have had their injuries, received while playing polo, most quickly cured than myself and then have taken such an active interest in the methods of cure. So I felt qualified to write the Dean's article.

From 1911 to 1914 I spent most of my spare time playing polo wherever I happened to be stationed in the Navy, except of course, during the war.

Polo is about the roughest and most exciting game I know, Rugby is rough, though the injuries suffered by players are less serious than those caused by collisions between polo players and heavy balls at high speed. Yet Rugby is played by more people in their early thirties, while I and many others played polo well into our fifties, when injuries became more frequent.

I hope I may be allowed to show a bit of a bias in reference to my polo experiences. I have 150 cups or more won in polo tournaments by teams of which I was a leading player. In 1906 the sixth edition of my book "An Introduction to Polo" by Macco, written 47 years ago, was published, with a chapter on treatment of polo injuries by Paradox. It is still the best rather than the best book on polo injuries.

I soon realised that for a team to get the winning tournament it was essential to keep them physically fit and quickly cured of any injuries occurred in play. And so I started asking in as many experts as possible and gradually became known as a deeply interested patient, so much so that I was invited by the Chartered Society of Physiotherapy to address them at their Diamond Jubilee Dinner on 12nd September, 1937. Since then I have been invited to address the Royal Naval Medical Club in 1939, the Royal Army Medical Corps Club in 1936, the Orthopaedic Surgeons in 1935, and, although you won't yet see the immediate connection, the British Veterinary Association in 1944 and the British Equine Veterinary Association in 1951.

Finally, I received a second invitation from the Chartered Society of Physiotherapy to deliver the opening address at their National Congress on 13rd September, 1936, almost exactly 21 years after my first address. The warm reception accorded to this address by the hundreds of physiotherapists who attended this congress touched me deeply.

In every case I spoke of my experiences and emphasised that the cure of polo injuries by Paradox and manipulation, and this is the line I propose to follow in this article.

I should like to begin by mentioning that muscular contractions by Paradox were first used therapeutically by Desobry of Bologna as far back as 1647, when

he reported his results to the Academy of Sciences in Paris.

However, he realized the fate of many innovations, its full physiological potential was never realized and scoffer derided it as a 'minute jumper'. I gather that the early applied it was extremely uncomfortable for the patient, which may have added to its unpopularity.

I believe the first practitioner in Faraday was a man called James Stone, who practised in Cleveland Road, London. Evidently he made a considerable reputation for himself as he was invited to treat King Edward VII for an acute syndrome of the testis.

On completion of the test, Stone prophesied to the King's physicians that one day there would be an electrical department in every hospital. The physician suggested he should not, for his imagination ran away with him, but 70 years later I know of only one London hospital which has not yet realized the vital importance of having an electrical department.

The Stone technique was quite different from any other and produced results which were tremendously more successful.

An extremely able young man called Morton Smart studied Stone's apparatus and method of treatment. Many of you will know that he passed his MD by a thesis on the treatment of strains and sprains. So I turned to Sir Morton Smart, as he once became, and he kept my team quickly cured of sprains, strains and contusions.

While being given Faraday by him, I poked his team and discovered for myself what area of you know well. I complained that first treatment had done me no good though temporarily easing pain.

He explained that the basic pathological condition in strains and sprains is caused by a tearing of tissue and an escape of blood and lymph into the tissues surrounding the injury. He told me that first treatment was designed to bring more blood to the

injured part, thus increasing the relaxation time. He stated that unless steps were taken to limit the additional extravasation, such as immediately applying wet water after heat, then it could extend further inside. It is apt to become organized and turn into fibrous tissue or adhesions, and once adhesions have formed, the application of heat can do little other than strengthen them.

In fact, heat, though extremely comforting, could not do anything towards relaxing or either the early or late stages of most injuries. He stated that in the treatment of strains and sprains it was essential to arrest extravasation or, if unfortunately formed, to prevent its organization and at the same time to increase the rate of repair of the damaged tissues.

This was only for done by asking the circulation to help absorb the extravasation and at the same time to increase the rate of repair of the damaged tissues and by circulation I mean not only blood flow to the part, but the equally important return via the venous and lymphatics.

Finally, it is clearly necessary to prevent the formation of adhesions, for if they are allowed to form I found it a painful process to have them broken down.

Unfortunately, such injury requires individual attention by the physiotherapist throughout the treatment. Sir Morton used to point out that to leave it purely to the machine was a thoroughly bad technique and could even do harm.

He told me that Faraday, given as early as possible, not only increases the blood supply to the part, but also the venous and lymphatic return at least on its early return that of the parts at rest. In addition the reflex movement caused by the treatment aids the prevention of adhesions.

Also, Sir Morton Smart was growing old and although he had created a clinic in Grosvenor Square, where we were treated on admission and, if there was no fracture,

we were treated at once. I transferred to Mr. Percival Stone, one of the original James Stone, because he certainly had what the Americans term "green fingers" and no one could apply the treatment more skilfully than him, but in discussing with him I soon came to the conclusion that he had nowhere near the understanding as Mr. Morton Smith.

Not long before the war he retired of retirement. I asked him who was going to take over from him to keep the Stone technique alive. He did not seem to consider this important, for he pointed out that no-one except old Mr. Morton Smith himself appeared to take the Stone technique seriously.

That was alarming and after discussion with other pole players we decided that a narrative to understand him and then take over his practice was really urgent. I knew of a brilliant young chartered physiotherapist whose 12 year engagement at the Royal Navy was just coming to an end and who had shown an exceptional interest and aptitude for Thorburn.

I tried as the fastest breaker to bring the two together and for the young man to learn from Stone and then take over his practice. So you can imagine my interest in the young man. Although also he is no longer young but well up on the scales and I am working on him to find a successor for himself to carry under him and finally take over his very considerable and important practice.

When I was First Marine Officer in the Mediterranean in 1951, one of my men, Captain Peter Major-General Sir Robert Neville of the Royal Marines, severely injured his back low down on the left hand side, with severe pain all up the back and down the left leg. He was in a truly painful condition and was told to rest by his ship's doctor, but allowed to receive treatment at the Royal Naval Hospital, Devon from the young naval physiotherapist

by heat and hand massage.

He was making no progress at all and we were worried still in our minds had to play an important fixed on the Saturday. By the Friday he was still no better and the young physiotherapist said "It doesn't look as if you will be able to play tomorrow, but I have a rather desperate idea. I have never done manipulations but I've just studied a wonderful new book by Dr G.J. Mennett and I am certain you have a strain or dislocation of the left knee that you can possibly the pain just above that is the left lumbar and the sacral. I think I could put it right by manipulations if you are prepared to let a novice have a go." The patient replied "I wouldn't be worse off than I am now, so proceed!"

They both came to my house in White, Class Melton, accompanied by Lieutenant Commander Charles Lambie who introduced me to Peter Sir Lambie and as I was an asymptote to the highly irregular action, not approved or even known by any of his superiors. The amateur manipulator had the patient out on my bed and treated his body first on the left and then to the right, producing cracks like pistol shots at each turn.

The patient stood up, then stretched his toes and moved about the room, paces through the museum of striking a pole ball without striking any pain and played brilliantly in the match on the following day. And so was born the first naval manipulative physiotherapist 42 years ago. I felt as though I had been present in a miracle and have never forgotten this great event.

I asked him to explain everything and whether he had taken any real risks. He shook his head, the patient had been X-rayed, the only risk had been his own lack of experience of the correct manipulative technique.

I then told him about Morton Smith's methods of Thorburn, but he knew Stone

that and added it was used daily at Eight for muscle and nerve testing, and for other conditions, such as muscle wasting by atrophy, on pads or by putting the limb being tested in a bath of water, switching the current on, and then leaving the patient to get on with it. He was at first astonished when I said Morton Smart used it as soon as possible after injury to produce astonishingly quick rates.

When I next saw Morton Smart I told him about how the Navy used Faraday. He laughed, saying that the dragging on of pads or putting a limb in a bath was just about the worst way of giving Faraday, most to presume that all muscles under treatment require the same amount of constant stimulation, which was manifestly untrue. He added that it was very wrong to give more than 10 or 12 consecutive contractions to any muscle.

My naval friend, for we have become real friends over the years, goes as far as to recommend that not more than three, or at the most four, successive contractions should ever be given to the same muscle before moving over to an adjacent area. Only one electrode should be strapped on, the other pad being held in the right hand and constantly moved, while with the left hand the strength of the current should be varied as necessary. In fact, treatment requires the whole time attention of the operator.

I continually looked the history of the first uncombined manipulators by a naval man to the naval medical authorities and persuaded them to accept that they had a man with great fingers at their disposal.

On his return to the Royal Naval Hospital, Haslar, the story of his manipulative success had reached him and I was afraid it did not endear him to his superiors. However, he luckily came under a really progressive Superintendent Surgeon Commander North, who was not only sympathetic but gave him every encourage-

ment. In fact, he provided my friend with every facility to perfect his manipulative technique.

Surgeon Commander North went as far as to persuade the senior authorities, another Surgeon Commander, to put him down under general anaesthesia before manipulation. This was an entirely unheard of procedure in the Royal Navy of the early 1930s, but paid great dividends for my friend because such a proficient manipulator that he was able to treat even difficult cases without anaesthesia at all. In fact, he came to prefer this so he could really feel his patients' responses.

When Sir Morton Smart published his important book "The Treatment of Muscles and Joints", he sent me a copy which I passed on to my friend. Meanwhile the latter bought all the works of Dr R J Mansell and under early manipulators and, in consultation with Morton Smart's book and the support of Surgeon Commander North, his life was completely unclouded as far as the treatment of injuries was concerned. In fact, North even arranged for him to work directly under Mansell for a brief period. Curiously, I knew him not what a nice old High Commissioner in the Bahamas and told him of his father's kindness to my friend.

After taking over Percival Smart's apparatus and position, my friend came to realize that if only the electrical stimulus the patient received at each contraction could be dynamically reduced, a treatment of far greater efficiency would be possible without discomfort, thus greatly speeding up cures. He experimented not only with the primary method of application but went so far as to wind his own transformer coils.

At a time when I had been elected President of the Institution of Electronic and Radio Engineers, I urged him to transform his apparatus, known as TRANSIVA, and with the help of an excellent electronics engineer they produced



a very small portable apparatus of far better all round performance. This in itself has been further underlined so that I am convinced the new TRANSIVA has made a real transformation of Foreman as I first knew it over 30 years ago.

When applied correctly in every detail there is practically no jelly displaced sensation. The rhythmic muscular contractions, in my hand now normal than, are sure to smooth that they have a soothing effect even when treating some cases and at far greater intensity than ever before. Indeed, I and others, have actually gone to sleep under the new working treatment.

But I believe the most important development in the treatment of injuries is the combination of physiotherapeutic and manipulative knowledge and expertise in the hands of one person as I particularly welcome the formation of the manipulative committee of the Chartered Society of Physiotherapists.

I attended the address I gave at the morning of the Orthopaedic Surgeons. This was at the Royal Naval Hospital, Haslemere, in 1956, just one day after I had had a hernia operation — I put on my uniform, for Admiralty of the First naval officer, and in my talk to them I quoted from Dr Moseley's book 'Physical Treatment by Movement and Massage 1945' — in referring to dislocated shoulders he wrote on page 148:

*"There can be no greater error than to suppose complete rest for the joint. This is probably the most fatal single cause of recovery. The stability of the shoulder depends entirely on the muscles; the contracta is unnecessary and if these muscles are allowed to waste, stability of the joint is impossible. Everything possible, therefore, must be done to maintain their strength and tone."*

*It must be strictly understood that it is after an abnormal movement freely during*

*the first week after dislocation that it will be during the third week of the joint has been immobilized by the doctor."*

In 1955 one of the famous Argentinian Authors for others and their points follow me on a multiple polo collision, dislocating my left shoulder. I have never known a more painful injury but I went for one moral lesson and received the right treatment, but can now go play polo again as it was the last week of the season.

In 1946 Gonzales Torres, one of the three players in the world who then had a handicap of ten goals, came down with his pony and suffered a sub-clinical displacement, in injury words, a severe dislocation of the shoulder. He was taken to Winchester Hospital, England and had his injury reduced under a general anaesthetic.

On the morning of the return of the club, my friend was called in and started treatment the following morning combined with voluntary exercises as soon as that could be done without pain.

By the following morning the bruising extended almost to the elbow. Nevertheless, 14 days later the patient declared himself cured as he could use the arm fully and as he opened it felt as good as before the accident. He was allowed out to play polo or raise his arm above the horizontal position for another week but this advice was ignored and on the fifth day he was back on the polo ground.

A few years later I saw Torres again and he told me he had never felt even a twinge of discomfort since and had in fact almost forgotten the accident. He did however tell me that other players who dislocate their shoulders in the Argentinian have them strapped up and immobilized and take six weeks or long before they are able to play polo again. He regarded his own cure as a real miracle.

I'd like to give you more example of one of our high handicap players who on reaching 30 gave up polo and took in

drawing four in-hand coaches. He had a fearful mishap: the coach turned over and all the horses came down, the driver was thrown into the middle of the flailing horses and frightened struggling horses and was badly jacked on one side of the abdomen between the ribs and pelvis. His condition was so serious that damage to the abdominal organs was feared.

The following day it was decided there was no abdominal injury but the horseman whom he had been locked had to be sent to the hospital. He lay unable to move or turn or raise his head, and had to remain in almost the same position for 24 hours. Then our friend started treatment with the TRANSEVA and five days later the distinguished person pronounced himself as cured though there still remained discomfort, but the swelling had gone and all movements were free and painless. Treatment ceased.

I used my friend to get post-natal treatment with TRANSEVA, which has been astonishingly successful. My eldest daughter, after having given birth to eight children, has a figure almost as good as it was 50 years ago, thanks to TRANSEVA, and so have many other women to my certain knowledge, including several famous beauties.

Now a brief word about the treatment of lame horses. Little and large. In 1958 I persuaded our friend to bring his portable TRANSEVA to the stables at Warkington, where a famous pump had gone dead some 10 months then. He gave it the same sort of treatment as a human with the same excellent result. It was back on the polo field after three treatments.

Then Hester intervened.

After my friend came back from the war he started treating horses again with continued results which so impressed the veterinary fraternity that they made a strong attack and got legislation passed that no one might treat a horse except on

professional veterinary advice. "A strong piece of legislation", I called it.

He soon found a well known veterinary surgeon, Fraser, who had served with me in South East Asia and who worked in close collaboration with him. Fraser kept a record of the best legaged cases treated and treated as an 85 per cent success rate, which has since risen into the 90's.

In 1962 the British Veterinary Association asked me to open their conference. I told them of the wonderful success the TRANSEVA apparatus had had in curing lameness and claimed the credit of having first suggested this to my friend — I expressed regret that they had not taken up TRANSEVA.

This so upset the vets that they called a press conference and denounced my speech which then received far more and all publicity than could otherwise have been hoped for.

Then the British Equine Veterinary Association was formed as a subsidiary and they invited me to address them in 1974. I repeated my story but this time it was received with applause and the President wrote to me about the TRANSEVA treatment, which by then had come into general use in many countries, as follows:

*"It was a genuine relief to be able to discuss the matter openly in public and I think it is now appreciated that your original criticism was intended to be helpful to the Veterinary profession. They should never have been interpreted as a form of antagonism which I am afraid they were at the time. I am full of admiration of your willingness to come, at it were, to fight a second round. Your speech will be printed in our Annual Report."*

I could not ask for more praise. Treatment from the British Equine Veterinary Association and am glad to be able to pay them this tribute. In 1976 we even took

remarkable event occurred in that the British Veterinary Association themselves turned my friend to present a paper at their annual Congress on "Farriarism as a form of therapy for horses against". It evoked great interest.

Now, as to my imaginary novel hero, with whom my successes started when he was only a finding neck for his intended, he particularly did not want me to exercise his name — so I won't. But I can't resist telling you that he has been knighted, and I believe, is the first physiotherapist-manipulator to be so highly honoured.

To end on a lighter note: when I was Commander-in-Chief of the Ministry of the Fleet, I used to send my players with injuries to Malta to the Royal Naval Hospital, partly with a suggested diagnosis and treatment by THAMBYA, for I had brought out out with me and given it to the hospital.

It was tedious and ungrateful, but such is

the loyalty of the Royal Navy that the only protest they raised occurred at the annual Regatta presentation. I and my family sat at the head row, with all the senior medical officers and their wives. All were well till the morning when the signal cut. A stage hand was tall on a ladder fixing a piece of scenery.

Horrified at seeing the curtain go up, he lost his footing and fell heavily, groaning. The stage manager dashed forward and shouted: "Is there a doctor in the house?"

Twenty-four doctors, headed by the Surgeon Rear Admiral himself, supported by nurses, women and not least staff, stood up to one, peering at me and calling out: "Yes, Doctor Mountbatten!"

In the whole I am not pretending to be a doctor or practitioner. I have written solely as a very experienced patient, and after all we patients know the truth of the treatment we receive, and we are all grateful to those who advise and endeavour to assist us with our sickness and injuries.



## Spontaneous Rupture of the Spleen Complicating Infectious Mononucleosis: A GP's View

T. Puri

### ABSTRACT

*A case of spontaneous rupture of the spleen as a complication of infectious mononucleosis is an ill-recognized but a reported. Several common features of this rare condition are commented upon and discussed. A brief discussion is also given of the unusual personal practice which in itself the case involved.*

### Introduction

Rupture of the spleen is well recognized after trauma but may also arise spontaneously with most causes of splenomegaly, particularly malaria and infectious mononucleosis (Cline and Smith, 1946), rupture being quoted as the commonest cause of death in the latter. The organ may rupture spontaneously in the absence of obvious congestive pathology. In such cases it may present itself as a perforated peptic ulcer or clinically as carcinoma of the stomach. It may occur in pregnancy or as a complication of haemoglobin therapy, and has occurred in association with acute pancreatitis and perforated duodenal ulcer (Dugg, 1973).

In infectious mononucleosis the spleen is alleged to rupture between the 10th and 21st days of the illness and at the end of 1973 only 33 cases had been described in the world literature (Ene, Whitaker and Hall, 1974). There have been others since but to my knowledge the current total has not been revised.

The incidence of infectious mononucleosis in the community is two cases per thousand of the population in each per year (Harley and Roddy, 1971). Taking an "average" United Kingdom lot of 2,500 people, the

GP can expect to see five cases per year. In these the incidence of spontaneous rupture of the spleen is 0.2 per cent (Chaff and Johnson, 1974). The "average" GP can thus expect to see one case every 100 years, and I shall be quite content if it is that long before I see another.

Not only is the condition unusual but the case occurred in the unusual practice setting of a five room Family Clinic, with a lot of approximately 100, in Fingate. It is run by a single-handed Rural GP complemented by a Senior Rural Nursing Sister and a PGMA. The patients are distributed over an area of approximately 50 square miles ranging from extremely urban to decidedly rural. The local hospital built-up is six miles from the clinic and between 5 and 25 miles from patients' homes. The hospital occupies an footprint of a 1/2 acre (roughly humped). There is one operating table, one blood bank, and laboratory facilities are limited to a full blood count. It is blessed fortuitously with a highly skilled surgeon whose usual appointment is also highly competitive. The surgeon, who is Director of the hospital, is single-handed and is therefore also consultant obstetrician and gynaecologist (the latter, physicians etc. He can do an Ashes speciality for assistance on which occasions he is interrupted but such instances are infrequent. On the very few occasions when he is away and unable to attend. There are approximately 50 beds, all of which are in single rooms. There are no open wards.

There is no reasonable ambulance service in Naples and the British are encouraged during times of emergency to do-it-yourself as the Neapolitans do, i.e. transport the patient as they can see with the least trouble consciously and have a white handkerchief flying from a window. This is alleged to lead to chaotic, hysterically apiring in the ubiquitous traffic jams which seem to maintain a national sport.

With the help of the neo-spectatorship it is obvious that had I a superior diagnosis ability than the patient could have been managed better. The events are described along with the opinion as to the hope that if any other doctor with an average diagnostic ability encountered such a case he may perhaps avoid some of my pitfalls.

#### Case Report

An 18 year old girl daughter of an EMU and hotel services entry took to a London Nursing College) attended with a two-day history of general malaise, high temperature (40.1°F) and headache. Examination revealed nothing other than minimally enlarged cervical glands, small conjunctiva and frontal sinus tenderness. A diagnosis was made of viral febrile illness and treatment commenced with Moxon Hydrocortisone 1 per cent in saline plus 2 qid Ibuprofen, Mefenol and Eucalyptol in halothane BPC qid, Ampicillin Caps 250mg qid for five days.

After four days the mother telephoned to say that despite two days of bed rest response from the girl had taken to her bed and was now as bad as when she first attended. This was a Sunday morning but as it meant she had had a P.U.O. for almost a week I decided to do a house call. Other than appearing slightly pale, there was no difference from the first examination. There were no joint tenderness and there was neither generalized lymphadenopathy nor direct viral infection laboratory. I considered the possibility of this being simply a

renewed virus infection but also very possibly due to refractory mononucleosis. I did not take a blood sample at this stage as the laboratory was shut.

I felt that there were two good reasons for stopping the Ampicillin, namely it was of no benefit and there was the possibility of infectious mononucleosis, but whether the diagnosis she had a troublesome acute infection which I wanted to try and cure. I therefore changed to Septrin tabs. I bed for five days and for the next 36 hours the temperature slowly began to drop and she showed a steady improvement. After this is on day 7 of the illness developed an acute attack of severe left hypochondrial pain with vomiting. The history was of an initially severe pain lasting for two minutes then going away to an ache with occasional severe colic. Vomiting occurred on these occasions subsided to the severe attack. Examination revealed persistent pyrexia (40.1°F) and pulse as well as a tender left hypochondrium with some guarding but no rigidity. There was no clinical evidence of free fluid when the peritoneal cavity and the bowel sounds were normal. The patient was tender to palpation over the left renal angle and the blood pressure was 100/60. There was still no generalized lymphadenopathy. I decided that in view of the prolonged fever, inadequate fluid intake and anorexia (possibly aided by the sulphamethoxazole component of the Septrin) I was dealing with severe colic due to the protraction of a total virus. I administered minocyclone Peridone Simg and Scenell 12mg. The plus oral Penicillamine 250mg four hourly was enough to settle the patient, who once more showed a steady improvement over the next three days.

The day after the acute attack of pain I took a blood sample on which a Monospot test was positive. I knew then that I was definitely dealing with infectious mononucleosis but had no reason to doubt the

velocity of my overall assessment. The subsequent blood count did give me a little food for thought. It was as follows: Hb 9.0G (m) 26%, WCC 7,600 per c mm (Neutrophils 31%, Lymphocytes 46%, Monocytes 1%, ESR 14 mm in 1 hour. Erythrocyte hypochromia.

I wondered why the haemoglobin was low. Likely causes in this age group were inadequate dietary intake or loss from heavy menses. There was nothing in the history to support these. Haemorrhage from other causes was another possibility but unless it was from the urinary tract I could not think of a source. Haemolysis was another unlikely possibility due to the Erythrocyte curve. As the patient was improving clinically I decided to wait two or three days before repeating the blood count.

The uncertainty, however, led me to read up the conditions during which loss I judged the most complicated of spontaneous rupture of the spleen. I discovered it as the parent was never shocked and in addition was uncommon. According to the books the condition never arose that early. Nevertheless, it caused such a crisis of fear that when on day 11 of the illness (the patient having remained as improved and this night) the mother came to say the girl had had another severe attack of abdominal pain and vomiting and had also fainted, I decided that rupture of the spleen must have occurred and although morning surgery half way through the night in the house.

I passed only an interplay of an extraordinary success and hourly peril to him that, after a telephone call from a nephew, I had made the diagnosis and was now going to see the patient and bring her to the hospital.

I drove home the night before and had her examined but it is a shocked state blood pressure 70/50, pulse 120/min. Guarding was extreme in the left hypochondrium and peritoneum revealed evidence of free

fluid within the peritoneal cavity.

To avoid panic I said I thought the patient had fainted as a consequence of fatigue and dehydration but that she needed hospital admission for observation. I then asked the mother and two siblings to carry her downstairs to the back seat of my car. Consent was given and the patient was lifted into the 12 seats in hospital, but previously had said my nephew (who is handicapped so I made do with an occasional generalisation of the arm out of the window. The mother came with me to find the girl and as soon I explained what I thought had really happened.

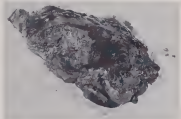
As the hospital the surgeon arrived that an emergency laparotomy was indicated but decided the diagnosis (which immediately raised my tempo-temporality). As he prepared for surgery I bled myself with Organon's tissue blood (All Rhone negative, of course). Our frequent benefactor, the American, provided some via an emergency Caribbean white cystic serum. The father (8 Rhone negative) provided two pints.

I was allowed to assist at the operation and was ready just as two litres of blood began to escape from the now opened peritoneal cavity. Within 30 minutes of death in case the patient's extended right paramedian laparotomy scar was being closed subsequent to removal of a spleen with evidence of rupture in two areas on the diaphragmatic surface (fig. 1). The spleen weighed 400g (normal range 100-200g).

## Discussion

Idiopathic monocystosis has a predilection for the young, only 21 per cent of cases arising in people older than 21 years.

The mortality rate of spontaneous rupture of the spleen in idiopathic monocystosis is high. However, vary between 53 per cent (Smith, 1956) and 59 per cent (Seligson *et al*, 1967). The commonest reason for death



is failure to consider the diagnosis, the mortality rate following splenectomy in the diagnosed condition being negligible.

It is interesting to note the two discrete areas of laceration on the diaphragmatic surface in this case (Fig 1). It is tempting to think that the center of the tear may have occurred on day 1, then ceased or healed thereby altering or inhibiting resistance of the monocytes prior to the grossly fatal rupture on day 11.

Shoulder tip pain is often the most outstanding feature of the rupture. This subsequently was determined to have occurred on the second episode of pain but was not the outstanding feature and did not occur on the first attack.

In infectious mononucleosis the characteristic histological features of the ruptured spleen are infiltration of the capsule, trabeculae, and sinusoids of blood vessels with lymphocytes and mononuclear cells as well as massive hyperplasia of the red pulp (Carter and Smith,

1954). These features occurred in the case described.

It is uncertain whether rupture occurs purely as a result of erosion of the pathological changes into the structure of the spleen or whether other normal activities such as clumping, swelling, defecation or even clonic pulsation of an enlarged and weakened spleen (Laguarda, 1933) cause a big history of these occurred in this case. The pain preceded the rupture in the first attack. Prior to the second attack, the patient was feeling so much better that she had not out of bed. Perhaps the effect of this is what precipitated the rupture, but I feel the point is academic.

Positive differential tests for the histioplasm antibody of infectious mononucleosis are usually regarded as diagnostic. False positives are rare but have been reported with psoriasis, maculoplasma (Schoff and Goldsmith, 1971), rubella (Pillay, 1972), and disseminated histria (Hewitt et al 1971). A seropositive of histioplasm antibody

infection may follow respiratory tract infection (Hargland, 1961).

It is unknown why patients with infectious mononucleosis develop a rash with Ampicillin. One hundred per cent of such patients are alleged to develop copper coloured maculae or papular rashes (Ford, 1967). This pattern is absent.

The patient has recovered well and I am at least certain that her exposure will give her invaluable insight into her personal illness.

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#### HASLAR, THE ROYAL HOSPITAL

In early December the General Society are publishing *Haslar the Royal Hospital*, an account of the history of the Hospital by Captain Christopher G. L. Hasler. Copies at 50p each are available from General bookshops or from Mr. Parsons, Haslar, PO20 8AA.



## The Last F.S.T. in Oman

A.H. Osborne and D.G. East

### ABSTRACT

The members of a Joint Service Field Hospital Team in Oman are described together with some operational details.

### Team Organisation and Administrative Problems

We were the only Joint Service Field Hospital Team ever to go to Oman. The team consisted of 35 members (Fig. 1). The surgeon and Officer Commanding was from the Royal Navy, the anaesthetist from the Royal Air Force, and the pharmacist and dental officer from the Royal Army Dental Corps. The remainder of the team were from the Royal Army Medical Corps and consisted of two State Registered Nurses and Radiographer, three State Enrolled Nurses, one Pathology Technician and four Operating Theatre Technicians.



Fig. 1. Field Hospital Team personnel.

ably led by a Warrior Officer 1 who had served 12 years with the Grenadier Guards prior to transferring to the RAFC.

We were apparently an independent unit: the next link in command being HQD 116. However, we liaised closely with the Brigadier of British Brigade who was himself seconded from the British Army. It was surprising how easily we integrated as a team, each respecting the Service of the others. Our Warrior Officer 1 learnt to sleep in a 'trench' and the RAF element learnt "to go ashore". The RN element became modestly efficient at Army administrative issues.

Our main problem was that of supply. We relied on a Hercules aircraft supplying us twice per month with all medical supplies. This resulted in long delays usually until our priority rating was upgraded so that towards the end of our tour we were nearly self-sufficient. Prior to this, however, we received and 'consumed' both from the Jordanian Army element and from the British Imperial Army.

We were fortunate in the nearby presence of a Royal Engineer Squadron which maintained our two ambulances, Land Rover and Beach Buggy.

The F&T buildings (Fig. 2) consisted of seven large tents. These included an equipment and administration office, a recreation area beside which was a helicopter pad, two wash each containing eight beds five with eight shelves on them so that a total of 24 patients could be managed



Fig 2 Sultan Qaboos

in comfort. The remaining beds included pathology and X-ray departments, a large storehouse which was not air-conditioned and finally an operating theatre with anaesthesia space (Fig 3). The Sultan's Army Hospital was situated at Um Al-Gharaf, two miles away, and patients were transferred post-operatively to the 28-bedded surgical ward there. The FRS surgeon visited two mornings a week doing a ward round and outpatient clinic.

The new Sultan Qaboos Hospital was situated on the outskirts of Salalah and had been opened three months prior to our arrival. It had been built by a West German firm and was desperately short of staff and medical experience to run a brand new modern hospital serving European

stateside. Civilian consultants were transferred to this hospital on completion of surgical treatment at the FST, and five operations were performed there at the request of our first surgeon. These included repairing a fractured neck of femur, pyelolithotomy and cholecystectomy.

Our two wards were continuously occupied by patients, accompanied by both parents in the case of the children. Mothers were dissuaded from smoking at the ward but it was not uncommon to see a 'cook up' in the adjoining showers. The only drainage occurred when the ward infection broke down and was not reported in time for the following night's evening.

#### **Background and Reasons d'etre**

Salalah (Figure 4) began as an airfield in 1928 for number 8 Squadron RAF on the Aden Iraq India air route/corridor route. During the Second World War it provided refuelling and overnight facilities for aircraft supplying the Burma campaign. From 1940 to 1945 Wellingtons were based there for convey and air-to-surface operations over the Arabian Sea and Indian Ocean. After the war the airfield was used by RCAF as a staging post between *Avro* Cors and *Canberras* and by the RAF on the 'tea-trip' route from Aden via Kowe, Muscat and Sharjah to Salalah.

Circumstantial signs of disaster already began in 1961 with destruction of airfield equipment and engine lying on the Salalah (Dhahran) road. This led to British Army units being tasked with guarding the road and munitions. By 1965 there was a build up of the Sultan's armed forces, using Hawker Hunter aircraft to cope with disorders taking in the Qura Hills. In 1968 the airfield, now guarded by a perimeter fence and concrete buildings, came under mortar attack and the road was used till the end of 1973 when the pro-Yemeni forces (with the help of Israeli Jordan and the UN) began to gain the upper hand in the war. Sultan Qaboos bin Said



Fig 3 Operating Theatre



Fig. 1. Arabian peninsula: British route.

had assumed power in 1976 from his father after a bloodless coup.

The Field Surgical Team was set up in 1973 to provide first aid surgical treatment for casualties required in contact with the disidents (locally known as Adnafi). Following reconnaissance and initial care, the British patients were aeromedically evacuated via RAF Bahrain to the RAF hospitals in Bahrain and Aden.

As enemy contacts decreased towards the end of 1973 the workload of various teams, RTA's, emergency and routine surgery increased until by mid 1977 the bulk of the work comprised general surgical care of the British's armed forces and the few remaining British forces. As described below, during our tour several battle casualties were dealt with and as long as the majority of war wounds (from explosions, accidents, gas, etc.) would there will be a need for a Military Surgical Team. Unfortunately this has now passed out of the hands of the British Forces.

### Anesthesia

The provision of an adequate anesthetic service was not a difficult task during our tour, but it demanded some ingenuity and not a little of the confidence which can only be developed through experience. For eight weeks we were without oxygen tanks and a large number of drugs had been allowed to run out of date. This situation had arisen from the last minute decision to keep the PFT British equipped and supplied until October 1977 and resulted in a long gap before we could re-establish the supply lines.

Thus it was that thiopentone or ethane and halothane in oxygen evolved as proved to be the most frequent anesthetic used. For children's surgery and generally all patients: GPPF with phenopentone and oxygen worked well using a Black & Blue Baskin's machine was used. After working with various masks, the anaesthetist had become so impressed with the Halothane machine in the PFT situation that he continued to use it in preference to "standard" equipment with a Boyle's machine. For the simple trauma cases induction with ketamine or a desflurane technique provided reliable anaesthesia. We were able to treat our fully armed ill our major cases before taking them to theatre in the accepted manner. This was perhaps a reflection of the routine treatment of battle casualties in the last part. Fig. 14 built up over the years in the



Fig. 2. Helicopter pad.

PST finally the most absolute attention to our "Beds" (Fig. 15) some 10 seconds after leaving the helicopter. Large canvas flasks oxygen and respiratory support, first aid and first-aid kits were all under way within minutes, followed by portable X-rays and even stretching when necessary.



Fig. 15. Resuscitating a patient.

Our experience in this area of our base work served to reinforce the lessons learned at many previous features of war and which are now fortunately being taught to most young doctors and medical students.

#### **Surgical Conditions**

Our stretching unit "blew up" within five days of our arrival and we were fortunate that instruments could be borrowed in the CSD Department of the local Quaternary Hospital. Laundry facilities were primitive and consisted of washing sheets and operating gowns with cold water with the addition, but not always of soap when available. Consequently gowns and sheets remained stained and soon had to be discarded. We kept our few remaining gowns for "hot risk cases" and otherwise operated in shorts, trousers, boots, mask and cap. We covered all our surgical patients with an appropriate antibiotic. We were fortunate to have only one infection during our stay; there being none of the instruments had been better kept and the

operating table was cracked. It had been condemned in Alexandria but kept for use with the PST in Oman. It was a marked improvement on the conventional collapsible PST table.

A large amount of the work involved trauma. No orthopaedic drill was provided but we were fortunate in being able to borrow a Wolf drill from the Royal Engineers Hospital. We had a complicated but efficient means of wrapping the drill in drops to avoid contaminating the patient or the surgeon's gloves.

We possessed no conventional screws between 1" and 1½" but managed to have a selection of 1" screws shortened to give a complete range of ½" screws by courtesy of Airwork Limited, who maintained the Sultan of Oman's aircraft. There have proved invaluable with regard to early fixation. We observed the most effect of a stabilizer wire by avoiding the proximal fragments.

#### **Cases of Interest**

**Case 1.** A British prisoner with an 18 month history of an enlarging swelling over the medial side of the right ankle. The swelling was found to be a fibroepithelioma 3 cm x 4 cm in size excised immediately before the lower end of the tibia and medullotomy with the posterior tibial vessels overlapped. Histology revealed a histiocytic sarcoma, the following organisms consisting of *Mycobacterium* and *Sarcosporium*. X-ray was normal and no evidence of systemic metastasis was present. In early presentation the tumour is enclosed in a capsule of fibrous tissue and may be dissected out. Such was the case. Outbreaks of lesions of adjacent tissue occurs with deepened histiocytic foci presentation.

Two children aged between 4 and 7 years were immobilized in by helicopter after playing with a metal prepacked grenade which exploded.

**Case 2.** Had damaged wounds of the head

which responded to wound debridement and delayed primary closure (DPS) in five days.

Case 3 sustained two sharp wounds of the right chest and the left (sharp) wounds of the right hand with associated superficial lacerations. DPS in five days included amputation at the distal interphalangeal joint of the middle finger and through the base of the proximal phalanx of the ring finger using multiple skin on flaps to cover the defects.

Case 4 had 12 sharp wounds of the body, an injury to the right eye with leakage of the vitreous. The eye injury was treated by enucleation, and repair of two fractures of the left tibia by excision of damaged tissue and closed primary closure.

Case 5 sustained traumatic amputation of the left hand (Fig. 7). The fingers of this hand were retracted from the wounds of the other children. Primary amputation was carried out through the radio carpal joint. Other injuries included 15 sharp wounds of the body plus full thickness lacerations and skin loss from shrapnel on the right hand and forearm. DPS in five days was successfully performed together with amputation of the right thumb which had developed gangrene, at the metacarpal phalangeal joint. Skin grafting to the right hand and forearm was performed ten days later using skin from the right thigh as the donor site. The final results are shown in Figure 8.



Fig. 7. Injury left hand (27/10/2001).



Fig. 8. Final result Case 5.

Case 6, the fifth child, had only superficial injuries.

Case 7 sustained a compound fracture of the skull, a right Colles fracture and a mid shaft fracture of the left femur after an RTA. He was brought in by jeep, sitting in the front passenger seat. Primary closure of the skull and reduction of the right Colles fracture were carried out under local anesthesia. The fractured left femur was placed on the third day using a heavy duty 24 hole plate (Fig. 9). Post-operatively



Fig. 9. Plated femoral fracture (Case 7).

the patient developed a pyrexia and this was thought to be due to blood transfusion reaction. However, examination of blood smears showed the presence of *Shistosoma japonicum*. He responded satisfactorily to chemotherapy. He was up-and-weight bearing on the eighth post-operative day and discharged two days later. He was fully weight bearing at six weeks.

Case 5, an 81 year old Danish woman, sustained a fractured neck of femur which was treated by a local doctor with fixation. She was brought in to the F&S by her son four weeks later. The only treatment he would allow was a hip spica. This was duly applied after rubricaine plaster application. The spica was removed six weeks later and a check X-ray showed early union. She was mobilised partial weight bearing and a final check X-ray at three months showed excellent bony union.

Case 6, a young 18 year old English boy was on holiday with his parents, presented with what is, atypical. He had been under the treatment of several neurological centres for transient limb epilepsy since birth and had been controlled in UK only with great difficulty. This was brought under control only after seven days treatment with sodium hyaluronate and paraldehyde. He was eventually mobilised on large doses of sparteine and sodium valproate. The boy then returned to UK with his mother, as it was felt the parents had been allowed to bring the boy to Queen.

Case 10, A 30 year old Jewish presented with a two day history of small bowel obstruction. A laparotomy for agnosed abdominal pain had been performed six months previously with appendicectomy. Abdominal X ray initially was normal and it was felt that his pain was due to adhesions. However, he failed to settle and further X ray showed a dilated small bowel loop. Laparotomy was performed which revealed a volvulus of small bowel the apex of which had become adherent to

the small laparotomy scar. Release of the involved small bowel was performed and the patient made a satisfactory recovery.

Case 11 was involved in an RTA and sustained multiple fractures of the mandible through the symphysis hyaline line, the tongue had not fallen back and the patient was breathing freely without the need for a croup extract airway. X ray examination revealed that the mandible had been fractured in one place on the left side and in two places on the right side. The left condyle was also fractured together with the lower margins of both sides. The alveolar process of the maxilla was fractured in two places on the left, one fracture uniting fractures 1 and 2 and the latter fractures 3, 4, 5, 6 and 7. The maxillary fractures were approached through a submental incision. The left side was held with a four hole Sherman plate and the right externally stabilised with a sliding T-type plate (Fig. 10). Apposition of the fractures was not perfect but the occlusal plane of the lower teeth was only slightly disrupted. Ideally this patient should have been treated using a cast metal exp splint and alone



Fig. 4. Patient with mandibular fracture (Fig. 10)

location, additional stability being given to the mouth using a connecting rod to a plastic head cap. It was felt however that the patient could not cope with intermediary fixation, no dental support was present in Orono, and oral enteral feed without what was essential. A wetted bandage attached to a head cap of course was used to maintain the lower jaw and proved satisfactory. The intra-oral fixations were undisturbed and there was no further deterioration.

Case 12 presented with a history of having fallen off a horse three months previously, injuring his right knee. He complained of recurrent pain, swelling and instability. Examination showed a torn medial ligament with rupture of both anterior and posterior cruciate ligaments. A right patellectomy transfer was performed. The plaster was removed at the end of four weeks and showed a satisfactory result. The patient was able to continue with his horse riding.

Case 13. The patient sustained a compound dislocation of the right ankle at which the inferior end of the tibia was totally exposed and the foot attached by skin and soft tissue to the anterior and lateral sides only. The fibula was fractured at the junction of the lower third and upper two-thirds (Fig. 11). Both medial and lateral ligaments were avulsed. Large quantities of fat and mud were present throughout the wound. There were double fractures to the 10th and 10th right ribs and a single fracture of the 11th rib.

Initial treatment consisted of debridement and debridement with reduction of the dislocation. The tibia-fibula fracture was externally fixed with a four hole plate. Open screw internal fixation was carried out eight days later (Fig. 12). His chest responded to intensive physiotherapy although complicated by a chest infection which responded to an antibiotic. Despite maximum reduction with internal fixation

the ankle remained grossly unstable. Amputation was eventually performed.



Fig. 10. Patellectomy - 10th August 1980 (2000).



Fig. 11. Ankle dislocation (single exposure).

**Case 14** A young English couple called their Land Rover which carried more than three before throwing them out of the vehicle. Both were brought in by helicopter five hours after the accident. The male had a 'C' shaped fracture from lower lip to bottom of chin extending through the buccal cavity. The mandible rapidly was being lost and the right buccal sulcus was disrupted. Pulpitis and root particles were present throughout the wound. He was semi-conscious on admission but soon rapidly died. The 24 h left rib was fractured. A thorough debridement to the chest with excision of dead tissue was performed one day after admission when she had recovered consciousness. The buccal sulcus was repaired together with the inner buccal incision. Formal delayed primary wound was carried out in the chest four days later.

His husband was breathing with great difficulty and had blood stained sputum with a retinal haemorrhage in the left eye. The pupils were unequal and he had exaggerated knee jerks, clonus during the night. There were pricks over most of the body together with gross swelling over L1-6. He was intubated on admission and placed on an *Iron Baby* Life Support. Both pulse and blood pressure gradually failed despite full resuscitative measures overnight and he died the following morning.

#### **Statistics**

We saw a total of 943 dependents at the PST and a further 179 at Glen Aldi General Hospital. There were 33 admissions, 111 X-ray examinations, 1046 exposures, 465 laboratory investigations and 337 physiotherapy treatments carried out by a post graduate physiotherapist whose husband was on contract to a UK building firm. Two hundred dental cases were treated. There were 108 direct surgical operations (e.g. inguinal hernia, mastectomy) 24

emergency procedures (e.g. perforated duodenal ulcer, varicosephagia), 13 primary battle casualties (shrapnel and gun shot wounds), 31 secondary procedures resulting from initial treatment of battle injuries, 34 primary trauma operations (e.g. RTA's) and 33 secondary procedures resulting from this (e.g. delayed primary closure and removal of marginal fixation devices). There totalled 239 operations over a 4 1/2 month period.

#### **General Practice**

The oldest building in the PST complex housed the medical centre which by 1977 consisted of our small rooms each for consulting, first aid, nursing treatment, dentistry and admissions. Officially the PST was treated only with providing a general practice service for those serving members of Her Majesty's Armed Forces in Oman, members of the Sultan's Armed Forces and locally employed civilians. In practice the number of patients seen was swelled by expatriate housewives, Omani (including members of the ruling family known as *Qiyas*) and the most influential of the local civilian population.

In March 1977 an incident involving the supply of scarce oxygen liquor to an Omani was brought to the notice of the Sultan and resulted in the closure of the camp to all but members of the Armed Forces and civilians actually employed on the mission. By the time our team arrived in Salalah there was little relaxation of the restrictions but our experience was that access to the PST was dictated by the local MCO who happened to be in charge of the gate post. The consultation or treatment was carried out by the PST to collect patients, bring them to the PST for treatment and return them thereafter. The finger was usually able to enter an ambulance that they left their personal autonomy at the gate.

Thus the patients seen were of varied origin, both sexes and all age groups.



occasionally with very little command of English. The FST was perhaps lucky to have the services of a Shu'bi adolescent-plastic-covered jacket or "Laffer" who served as clinician, runner and interpreter. He had worked with several of the FST units and had learned his English from American RAF and Army FST personnel — it was then restricted but well stocked with clichés.

A typical working room, therefore, contained a wide variety of patients but we were a little disappointed that the pathology brought to us was much more limited. Conditions were in any British consulting room provided the bulk of the work — U.K.I., gastroenteritis, orthopaedic ailments, psychosomatic illness and skin problems. There was an expected preponderance of older patients, including diabetics, arterial hardy and home-sickness.

Thus it was that any case out of the ordinary was subjected to surgical and anesthetic opinion, a battery of laboratory investigations and several visits from the King's dispenser. Despite this, we met with some success in treating our share of "import" disease. Among the more interesting encountered (and identified) by us were malaria, leishmaniasis, Chagas, tuberculosis, syphilis and non-specific urethritis. We were able to see more of interest in the Uin Al Qawad Hospital which housed a busy medical ward. Leprosy, trachoma, hepatitis and skin and several diseases and so on.

To conclude on the general practice aspect of our experience with the FST, we were stimulated by the necessity of excluding major disease and treating pathology covered our normal operations and also spread by the limited range of drugs available to us. We regret that several patients whom we wished to follow up were either lost in the Empty Quarter or returned after our departure.

#### Social/Recreational

For the first two months of our tour the weather was very unsatisfactory for those who wished to develop a sun tan. The local mosque or khawf lay like a blanket over Salalah plain and the jibbi group persistent grey clouds, continuous drizzle, high temperatures and humidity and, following heavy rainfalls, a lot of material damage due to inadequate storm drainage. Thus our leisure hours, so far as sport on the end of a telephone or rolled ball, were mostly spent indoors or playing volleyball on a wet court.

At this time, on most Fridays (the Islamic day of rest) we were able to equip ourselves with Land Rovers, a radio, rifle and a cold box and drive over the jibbi to the Apus pools. These geographical breaks were a treat to us. Some 15 miles beyond the khawf they lay on the edge of the Empty Quarter in a series of deep rock storm walls. After a steep climb down 200 feet of cliff, we were greeted by deep pools of deliciously cold water, a million miles from the hot weather of Salalah. A cottage of armed pickets in radio contact with Salalah allowed us to be contacted if required back at the FST and also to be loaned should any of the low remaining Adnis take an interest in us. In addition, there were miles of empty sandy beaches, but the sea was too treacherous during the khawf in boats.

A good relationship existed between FST personnel and various groups of separate British workers in Salalah. We were added to them for their personal hospitality and friendship, if not for their habit of leaving us in football, cricket and volleyball. The staff of the military hospital at Uin Al Qawad tried, with much success, to convert some of us to marijuana and to them can be attributed responsibility for many weight increases.

The length of our tour, some 4½ months, allowed us to enjoy life as an Arab

country without one of the most liberal of the Middle East States) and we learned much of their customs, Islamic laws and culture. Oman is only now emerging into the twentieth century and everywhere we saw contrasts between the almost medieval life style of only a decade ago and the modern technological features of today: the fisherman who landed his harvest from a primitive fishing boat made his way home barefoot and washed his fish on ancient televisions before going to bed.

We feel that many things can be said for and against such a place as Salalah — but we are all agreed that the PST tour was an education for each of us. Depending on our

personality and specialty, we all learned something of ethics, moral tolerance, economic equity, socialism and international cooperation rather than rivalry. In short "it is a good place to have been to."

#### Acknowledgements

We should like to thank all members of the PST for their kindly companionship and hard work, HQ District Brigade for their military assistance; Lieutenant Colonel Mulla, Medical Officer-in-Charge for Al Qawad Military Hospital, for medical supplies and social recreation, and finally Mrs J Taylor, Ophthalmic Department, Royal Naval Hospital, Oman, for typing the manuscript.

## BOOK REVIEW

**LABORATORY** is manual for the medical profession, edited by H. W. R. Rogers, M.D., Lecturer, London Polytechnic Inst. (1970) 346 pages illustrated, £5.00.

This is a manual for students in a postgraduate laboratory in especially so framed by an unusual subcommittee. Indeed, apart from a chapter devoted largely to the use of statistics, the contributors are mainly UK consultants or consultants from New Zealand in Central Australia.

The material is in five parts. The first discusses analytical chemistry and clinical pathology which may be undertaken by a general practitioner. For non-practising or consultants and non-practising of results that should be undertaken in pathology laboratories. The first part, discuss the laboratory management of clinical specimens and their collection, storage and transport. There is a small notes section. The chapters throughout are written with enthusiasm. The importance of close cooperation between the clinician, laboratory personnel and the laboratory is stressed. The guidelines are precise, systematic, consistent and concise. Equally with the necessary full clinical background for correct interpretation of results is provided.

The part on the laboratory management of clinical

specimens is very clear guidelines. The chapters discuss an outline programme of tests relevant to the general problem of not be particularly useful for the laboratory doctors to ensure that they found and very real saving points being the data relating to a clinical and management of their process.

The last section on "Chemistry, Drug Chemistry" will be of increasing significance in terms of the role increasing role of of potentially new drugs used.

The chapter on clinical use in general and the part on the consulting process and in the subject of long-term the subjects of appropriate management and in some of their interpretation.

Though primarily aimed towards the general practitioner, it contains useful information for all clinicians. The book is short, up-to-date and in very well and planning laboratory management available to read.

In this country with established pathology services available to all doctors, it is rather the luxury of this manual. However, wherever in the systems, would certainly improve both the management and efficiency of laboratory service.

## Extraoral Presentation of Malignant Lymphoma Lymphoblastic in the Testis of a Child

A. H. Osborne, J. H. Buchanan and A. Marks

### ABSTRACT

A case is reported of a rare testicular lymphoma presenting with extratesticular signs which was found at the time of a testis biopsy performed. The authors discuss the use of malignant lymphoma (leukaemia) of the extratestis and cystic testicular tumours and compare to therapy as discussed.

### Case Report

The patient, a male Caucasian of seven years, presented to the Urological Department, Royal Naval Hospital, Haslar, on 22nd November 1973 with a three week history of feeling generally tired. His mother had noticed a swelling in his right testis and scrotal tenderness of the abdomen.

Examination showed an enlarged right right testicle with thickening of the right vas. The abdomen was distended with evidence of ascites fluid. A subcutaneous mass 2 cm in diameter was present in the left testis. The spleen and liver were not clinically enlarged and no lymphadenopathy was present.

The child was immediately admitted to hospital. Investigations showed a haemoglobin of 9th grams/100 ml and an ESR of 42 mm in one hour, the white blood count was 1,100/cu mm with normal morphology, the leucocyte count was 3 per cent.

Exploration of the right groin was carried out and a large cystic scrotal was found with secondary growth extending along the cord to the external ring. Right orchidectomy was performed with evidence of the cord at this level. A small redness lateral egg was found and this was opened.

Blood stained ascitic fluid was present. The testis was dissected free and ligated. The subcutaneous mass over the left testis was completely excised and all margins were cryoprotected with penicillinase of mercury. After excision, frozen section on both specimens, showed the histology to be that of lymphoma.

Postoperatively the patient developed a perityphlitic abscess. This resolved after four days when he was transferred to the Oncology Department, St Bartholomew's Hospital London. Following admission there, treatment was delayed for a few days on account post-operative recovery and full staging of the disease. Staging according to the Ann Arbor classification for Hodgkin's disease required a full blood count, bone marrow and lumbar puncture, abdominal paracentesis and assessment of liver function. (The child was too ill for a liver biopsy). The results of these tests showed a normal blood count and bone marrow, lymphoblastic infiltration of the cerebro-spinal and ascitic fluids and abnormal liver function tests. It was therefore evident that the disease was extra testicular/extra testis and the staging was —malignant lymphoma—lymphoblastic type, Stage IV with central nervous system involvement.

Treatment commenced with vincristine (1.5 mgm/m<sup>2</sup> [8]) along with allupurine and prednisolone (40 mgm/m<sup>2</sup> daily). The response to this was poor and one week later a further course of vincristine in combination with cyclophosphamide (800 mgm/m<sup>2</sup> [8]) was injected. There was

rapid regression of the disease. A further course of vinorelbine and cyclophosphamide was given after another week and within five days of this there was no sign of systemic disease. The CNS disease was treated with five injections of cytarabine arabinoside (50 mg/m<sup>2</sup>) and the acetate of propyl B<sub>12</sub> (K<sub>12</sub>) remained clear of lymphoblasts after the second injection. By definition complete remission had been obtained and all drugs were stopped. A final course between doses of 8 mg/m<sup>2</sup> cytarabine (50 mg/m<sup>2</sup>) was started (Table 1) (Lassus *et al.* 1974).

Although the COP was clear of lymphatic blocks, post-experiment suggested it was unlikely that the CNS disease had been eradicated. Critical speed evaluations were therefore given a dose of 2,500 rad with the intrathecal injection of methotrexate (10 mg/ml) over the course of treatment.

The course of radiotherapy was prolonged over five weeks instead of three because of a persistent low white blood count.

Following evaluation at home we decided to start full intravenous chemotherapy. The protocol, which is similar to the Royal Marsden Hospital's acute lymphoblastic leukaemia (ALL) intravenous schedule provides for an intensive maintenance programme consisting of 8 weeks' treatment on oral maintenance with 6-mercaptopurine (250 mg/m<sup>2</sup>/day) and weekly cyclophosphamide (200 mg/m<sup>2</sup>/weekly) and intravenous (200 mg/m<sup>2</sup>/weekly) one week's intensive course on idarubicin, vincristine, cytosine arabinoside and remission with prednisolone, followed by one week's rest to allow the bone marrow recovery (Mellison, 1977). (Table 1). However, on view of the leucocytosis on the third cycle of oral maintenance

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Figure 1

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graph TD
    Start([start]) --> Input[/input x/]
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    Formula --> LoopStart
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x	1	2	3	4	5	6	7	8	9	10	11
f(x)	97.7954	95.5908	93.3862	91.1816	88.9770	86.7724	84.5678	82.3632	80.1586	77.9540	75.7494

TABLE II

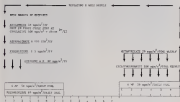


Fig. 1. Malignant lymphoma of the testis of a 12-year-old boy.

#### POSTMORTEM FINDINGS

possible to give it a macroscopic with two short courses of cyclophosphamide and methotrexate. He also had intrathecal injections of methotrexate in three meningeal intervals. This case fulfills the criteria for a testis tumor. The low tumor mass may be a reflection of his low tumor mass resulting from spinal irradiation.

Osborne's case had very little macroscopic treatment. He has remained in good health and is complete remission.

#### Pathology

##### Gross Pathology

The radical orchiectomy specimen consisted of a testis with epididymis of  $1 \times 1.5 \times 2.5$  cm with an associated spermatic cord measuring 7 cm. The testis was replaced by a rubbery gray-white uniform tumor which had completely replaced the testis and epididymis. It had

extended the full length of the cord and formed a continuous solid structure. No normal structures were discernible. The subcutaneous tumor was in the shape of an elliptical gray-white mass measuring  $3 \times 1$  cm.

##### Histology

Sections showed wide separation of immature noninfectious tubules by a dense infiltrate of small lymphocytes. Tumor lymphocytes showed appearance of a diffuse malignant lymphoma lymphoblastic with small round cells having hyperchromatic nuclei and numerous mitoses. Focal areas of plasma cell infiltration were present (Fig. 1).

Stains in demonstrative sections three showed a dense network of reticulin surrounding the tumor cells between residual seminiferous tubules. The number



Fig 1. Epithelioma showing wide separation of cellular lin. a dense collection of tumor lymphocytes (H.E.  $\times 1000$ )

was seen to be invading vessel walls and to be filling the lymphatics. The epidermis and epimysium were showed complete replacement by tumor with infiltration of vessel walls and of the vas.

The tumor had been received as formalin and the nuclear studies were therefore possible.

High power microscopy using thin sections of Epon-embedded material showed the tumor cells to have condensed nuclei. This was also confirmed on electron microscopy (figs 2a and 3b).



Fig 2a. Epithelioma and fibroblast in a condensed lin. (H.E.  $\times 1000$ ) (epithelioma with condensed nuclei of lymphocytes (H.E.  $\times 1000$ ))



Fig 2b. Epithelioma showing a dense collection of tumor lymphocytes (H.E.  $\times 1000$ )

### Discussion

Neoplastic disease is uncommon in child hood but comprises the second most common cause of death in those under 15 years of age. In England and Wales less than 0.5 per cent of total solid tumours were in the under 15 (Gordon and Stewart, 1963). Out of 150 muscular and mesenchymal tumours recorded by the Yorkshire Tumour Panel between 1958 and 1973 in patients up to 15 years old, only four cases of malignant lymphoma were reported. The youngest was aged one year and the others 12, all died of disseminated lymphoma within a few months of diagnosis. The most common tumours in this age group were the yolk sac tumours (teratoblastomas), paraneuronal tumours and differentiated sarcomas (JIT). The malignant tumours usually encountered in adult life — malignant leukaemia, sarcomas and lymphomas — were rare (Brown, 1974).

The problem posed by a non-Hodgkin's lymphoma presenting as an intratesticular mass in the testis or any other organ is whether the neoplasm is primary or the site of development or whether it represents only one moiety of an already disseminated disease. While the broad clinical sign of a lymphoma is often a testicular mass, especially in patients over 50 years of age, experience has shown that this is usually an indication of generalized lymphomatous disease (Tinsman et al, 1971). Management of such lesions has usually required radical orchiectomy with local radiotherapy and although a few patients have been cured by such therapy, rapid systemic progression is characteristic (Giveng, 1964).

This case illustrates the typical features of a lymphoma presenting as a testicular tumour — that of a paucity of tumour nodules, nodules of several weeks duration with increased evidence of nodal cortical disease. It also emphasizes the need for accurate clinical staging and histopathological classification in management. All tumours in the Testicular Tumour Study were composed either of poorly differentiated cells of the lymphocytic or large undifferentiated leukaemic cells; there were no cases of well-differentiated lymphocytic lymphoma or follicular lymphoma (Giveng, 1964). The possibility of Burkitt's lymphoma was considered in this case since 10 per cent of male children with this disease have testicular tumours (Wright, 1971). However, a 'starrysky' picture was absent and the neoplastic cells did not have the characteristic basophilic and pyrenophilic cytoplasm and cytoplasmic vacuoles seen above. Furthermore, the nuclear characteristics of the cells were not those of a Burkitt's lymphoma.

New concepts in classification and the use of markers and electron microscopy are leading to further understanding of lymphomas. A functional classification based on differentiation into T and B cell

lymphoma has been proposed (Lukes and Collins, 1971) to replace that of Rappaport (1966). Barcos and Lukes (1970) suggested that some T cell lymphomas can be recognized by the presence of cytochemical stains in the neoplastic cells and that they represent a new and distinct morphological entity. These tumours usually occur in older children and young adolescents and there is a high male to female ratio. Frequent presence of mediastinal tumours, early bone marrow involvement with rapid progression to leukemia, blood picture and clinical features similar to some lymphoblastic leukemias (ALL).

Hadwies, Kim and Rappaport (1970) studied 30 cases of diffuse, poorly differentiated lymphocytic lymphoma with tumour cells containing variable numbers of ALL. They divided them into three sets and without nuclear investigation and found that there were helpful but not essential for recognition of the tumour cases. They suggested the term malignant lymphoma lymphoblastic for this group, either 'uninvolved' or 'non-involved'. They could not confirm that lymphoblastic lymphoma of convoluted cell type was necessary of T cell origin.

These patients who received only local radiotherapy had a median survival of eight months. In contrast, children who received comprehensive anti-leukemic therapy in addition to local treatment for 'undifferentiated lymphoma, non-Burkitt type' had median survival of 30 months and longer.

Chemotherapy in the treatment of disease in disseminated lymphomas but the agents employed do not cross the blood brain barrier. Specific treatment of therapy for the CNS disease must also be employed. Current protocols use a variety of systemic agents which may be given, either singly or in combination, against lymphoma. The protocol used in this case was empirical, the drugs being combined on





## Early Diagnosis of Ankylosing Spondylitis

### M. Hackett

#### ABSTRACT

*New data on the prevalence of ankylosing spondylitis is presented and it is suggested that the disease is under-diagnosed. The significance of early diagnosis is stressed and a simple diagnostic scheme for early diagnosis is offered.*

#### Definition

Ankylosing spondylitis (A.S.) has been simply defined as "a chronic condition of the spine and sacroiliac joints in which early inflammatory changes are followed by progressive restriction of spinal movement associated with radiological evidence loss of spinal ligaments".<sup>1</sup>

#### Pathological Progression

For the purposes of this article the progression of A.S. can be divided into three stages.

*Early disease*, in which acute inflammatory spondylitis produces localized pain and stiffness, but joint ankylosis has not yet occurred.

*Intermediate stage*, where pain and stiffness persist and chronic ankylosis in affected joints produces mechanical limitation of movement.

*Late stage* in which bony ankylosis of joints has occurred, leading to spinal rigidity.

Can medical treatment slow or arrest this progression?

In the early stage, limitation of spinal and rib movement may be minimal, and the combination of anti-inflammatory analgesics and daily mobilizing exercises after the first phase of maintenance of normal joint mobility.

In the intermediate stage successful treatment of ankylosis is less certain, for the affected joints are already becoming "frozen", but considerable useful improvement in joint mobility can be obtained by physical and drug treatment (Wynn Parry, 1970) and in a proportion of S.A.P. spondylitis treated at the Fort Stevens Medical Rehabilitation Unit, there was reversal to normal serum standards.

In the late stage bony ankylosis has resulted in permanent stiffness of spinal segments, resistant to all treatment.

#### The Importance of Early Diagnosis, and its Problems

As noted above treatment of A.S. can be most effective only in the early stage of the disease, but major recognition relies on prompt accurate diagnosis. The diagnostic criteria commonly applied at present in formal surveys or trials on A.S. (Bennett and Wood, 1964) demand that radiological ankylosis be present, together with a variety of clinical signs including restriction of lumbar and spinal movement. These diagnostic criteria may not be sufficiently sensitive for the detection of the very early case who may present with a relatively brief history of spinal pain and stiffness relieved by exercise but in whom no

<sup>1</sup>Wynn Parry, "Early Disease: All the Ankylosing Spondylitis", *Medicine and P.R.* Nov. 1970, by the permission of the publishers, John Wiley & Sons Ltd. (1971).

abnormal physical or radiological signs may be found, apart from spinal or sacrocaudal tenderness. To delay appropriate treatment of such a patient until conventional diagnostic criteria are satisfied denies him the chance of optimum recovery, and, in the case of a Serviceman, increases the likelihood of his being surveyed and awarded from the Service.

#### **Alternative Diagnostic Criteria**

Cole et al (1977) have proposed simpler diagnosing criteria for A.S. which rely solely on the clinical history and which, by excluding measurable limitations of movement and radiological abnormalities, may be more readily applicable to the detection of the early case.

- 1 Age of onset less than 40 years
- 2 Insidious onset
- 3 Duration at least three months
- 4 Morning back stiffness
- 5 Improved with exercise

Four or more positive responses give a result 95 per cent sensitive and 85 per cent specific for spinal A.S. This accuracy has been verified by comparison with conventional criteria supplemented by tissue typing.

All criteria in the list of Cole et al are equally weighted, perhaps significantly in his review of A.S. in the RAN, Wynne Parry (1966) noted that 86 per cent of patients had had symptoms for three months or less when a correct diagnosis of A.S. was made. Thus strict adherence to Scherman et al's three criteria may extend diagnosis to some cases. Further, the fourth and fifth criteria define the characteristic pain pattern of inflammatory spinal disease, and perhaps deserve heavier weighting. **Epidemiology**

Lawrence (1961) proposed a prevalence for A.S. of 0.4 per cent in the general white male population. Woodrow (1977) calculated a new prevalence of 1.1 per cent in white males. Woodrow's data depended largely on the use of the HLA-A2/B27 heterozygote

as a population screening tool, and the same technique was used by Cole and Pease (1976), whom cited a prevalence of A.S. agrees with Woodrow's and who suggest that A.S. is underdiagnosed to some by a factor of six to ten.

#### **Implications for the Royal Navy and Royal Marines**

There is no reason to suppose that the detection rate of A.S. is any better in the RN and RM than in the general population. We have 60,000 men in the RN and RM under the age of 45, drawn from the Department of the Medical Director General (Pland) and while the prevalence in this selected group of men is not known and may be different from the general population, one suspects that many A.S. sufferers in the Service base their mild chronic backache without complaining to their medical officer, or are misdiagnosed as suffering mild back strain, "lumbago", "lumbago" etc.

A.S. is the commonest rheumatological cause for disability from the RN and RM, whereas from the Department of MEDC44, and an improved detection rate would not necessarily increase the number disabled but would certainly result in early relief of symptoms and long term maintenance of fitness and mobility.

#### **Conclusions**

- 1 A.S. is more common than hitherto realised.
- 2 The peak and male preponderance of the Service population demand that A.S. be considered in the differential diagnosis of all young men with backache.
- 3 Early diagnosis and early treatment are mandatory if disability and invaliding are to be avoided.
- 4 A simple diagnostic scheme is offered to avoid the need to make diagnosis.
- 5 Persons suspected of having A.S. should be referred to the nearest naval hospital for confirmation of diagnosis and the early initiation of treatment.

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## LETTER TO THE EDITOR

Sir,

After completing the questionnaire on my non-smoking habit, I compared the following table, which compared me and which I feel ought to be of interest to medical officers (trying to put up the habit, or persuade their patients to do so).

I am (1) Private 1. Tobacco as General Practitioner and take every opportunity to enthusiastically impose my opinions about the habit upon smokers and have found

great benefit for my argument and reinforcement on their behalf at the cost of their smoking.

There are now scarcely five people who smoke 50 a day, but there are many households where the calculated cigarette consumption is that much or more for a husband and wife.

Yours etc.,

A. Morrison

Surgeon Lieutenant R.N.

Expenditure cigarettes per day	Qualitas. Smokers		Royal Navy. Smokers			
			Smokers/Smoker		Smoking only	
	1960 per year(1)	1961 per-100 smokers	1960 per year(1)	1961 per-100 smokers	1960 per year(1)	1961 per-100 smokers
1	46	63	11	17	11	17
20	91	136	19	30	19	30
31	137	204	49	80	33	50
40	151	223	114	175	45	67
50	174	268	139	215	130	197
60	200	293	206	315	150	243
70	216	313	267	391	201	319

- NOTE: a- Civilian expenditure reported as 10-50 per 30 cigarettes.  
b- All smokers assumed as males (1) 300 days free per month above-board, till 400 days free per month in company only attractive.  
c- Navy free cigarettes reported as 11-40 per 200 cigs (2000 1971).  
d- Smoky position income demonstrates that in order to put the cost per pack over the smoker, income tax will have been paid at 50 per cent.

## Rewarming via the Airway (CBRW) for Hypothermia in the Field?

William J. Gault

In an earlier paper (Gault, 1994) it was suggested that further work was needed to determine whether nasal body rewarming via the airway (CBRW) could be beneficial to hypothermic casualties under field conditions and whether it had any advantages, medical or operational, over other resuscitated techniques. Lloyd *et al.* (1992, 1993) first described equipment for providing hot moist air by placing catheters directly into a Waters canister containing water and suggested that it might be useful in the field. Subsequently several other clinical techniques and clinical cases were cited in support of CBRW. Hayward and Strimmon (1992) and Collis, Spelman and Chancy (1997) later give figures showing small increases in deep body temperature (DB) in subjects with induced mild hypothermia ( $T_b$  35.0 to 36°C) who were rewarmed by inhalation of warm humidified oxygen, but in an experimental subject with colder lowered  $T_b$ 's Golds and Harvey (personal communication) showed that inhalation of oxygen with warm humidified air had no advantage over spontaneous rewarming by body conduction and shivering. A few field incidents in which early type basic CBRW equipment (based on Lloyd's design) was used for casualties with mild to moderate hypothermia have been reported and cited in favour of CBRW, but the evidence is not convincing. In fact to date no conclusive evidence has been presented to suggest that CBRW should be adopted in preference to other treatments by the

rescue services in the field.

Following the interest generated by Lloyd's early work, the author has investigated some medical and operational aspects of CBRW in collaboration with colleagues in other services closely concerned with the practical problems of exposure and hypothermia in the field. Problems of treatment under the wide range of operational conditions possible in war or land rescue situations are seldom simple. The rescue services have many problems to consider, involving not only the design and reliability of equipment but also its ease of use and the amount of training and handling which is required. CBRW is not simply a matter of putting heat into a casualty, but of obtaining a sufficient heat input at a safe respiratory temperature in a limited period of time in the most significant benefit to the casualty.

### What is a Safe Respiratory Heat Input?

Before considering the use of heated humidified air for CBRW, a safe upper temperature limit for the inspired air had to be established to eliminate the risk of burning or scalding the casualty's airway. Lloyd *et al.* (1992) and Morris, Hennessey and MacLennan (1990) suggested inspiration of warm/hot moist air at 38–40°C as being safe, while warm/hot dry air can be inspired at quite high temperatures for limited periods without damage to the airway. The high inspired heat of respiration of hot moist/wet air greatly exceeds the heat content of equivalent temperatures





### General Conclusions

#### Accuracy of estimation

The possible value of CIBW must be considered in relation to the heat and moisture events in the respiratory cycle. Good accuracy of the heat relationships throughout the cycle and the temperature changes during inspiration and expiration are given by Gude (1953a & b, 1954a & b), Jackson and Schmidt-Nielsen (1954), Walker and Wills (1964), Wills (1965) and others, while Skrepps (1977) discusses heat exchange at estimated respiratory gas fluxes: mitochondrial metabolism.

In normal respiration, the net heat loss to the body is the amount of heat and water vapour given up by the mucopharynx and trachea to spiracular gas and heat loss to  $T_b$  the inspired air, minus the heat and moisture recovered on expiration by heat exchange between the water saturated air from the lungs and the cooler masses of the upper respiratory tract.

In cold ambient environments condensation of the inspired air will be greater, but so also will be respiratory heat loss so that the total net loss is greater. In open-circuit CIBW no heat is given up by the body to warm the inspired air and there is, therefore, a net gain equal to the heat spent minus the heat lost on expiration — a gain which may appear to be substantial. In a perfect closed-circuit system the heat gain equals the total heat input, there being no loss on expiration (theoretically).

#### Calculation of heat loss and rate

There are various opinions on how to calculate respiratory heat relationships, the following are based on changes in the specific enthalpy of the respiratory air during the respiratory and respiratory phases of the respiratory cycle. The BIVE Psychrometric Chart was used to take account of heat, moisture and volume changes in the respiratory air and water vapour during inspiration and expiration.

The survey temperatures used were based on figures given by Gude (1953a & b, 1954a & b), Walker and Wills (1964) and Wills (1965) and on figures obtained in the current study — inspired air temperature at about 4°C below  $T_b$  in thermoneutral conditions and 5–6°C (plus 4°C) below  $T_b$  at 0°C. The full calculations will be published elsewhere but for present purposes Table I shows theoretical respiratory heat gain and losses in normothermic ( $T_b$  37°C) and hypothermic ( $T_b$  30°C) subjects in thermoneutral (23°C) and cold (0°C) environments with CIBW at 45°C/100% RIL and at different ventilation rates.

A wide range of respiratory heat gains and losses may be expected with different ventilation rates, but Table I shows that with normothermic subjects at rest, and breathing ambient air at 23°C or 0°C at 5–10 l/min, between one-quarter and one-third of the heat required to maintain the inspired air is recovered on expiration. This represents a loss of about 6–11 per cent of basal metabolic heat production at higher ambient temperatures, and up to about 20 per cent in cold conditions.

With hypothermic subjects ( $T_b$  30°C) breathing unwarmed air 1 l/min the heat loss figures are here compared with normothermic. This is due to the lower metabolic heat content of the reduced mean body volume (RL) and the resultant decrease in contributing thermal mass. Nevertheless, the loss may still be important in relation to the low heat production capabilities in hypothermia — 15–40 kcal/hr (MacLean and Embley Smith (1977) indicate substantial reductions in BMR with low body temperatures — 30–45 kcal/hr at  $T_b$  33–30°C against 71 kcal/hr at  $T_b$  37°C).

Current studies using an isolated trout clearly show that normal mouth-to-mouth artificial respiration (10 l/min) on a hypothermic animal effectively

cancel the respiratory heat loss of the patient, even at ambient  $1^{\circ}\text{C}$ , as the air inspired from the resuscitator may be several degrees warmer than the  $T_b$  of the casualty. A definite heat gain is produced by the use of an insulated runway in warm conditions, or, better still, direct warmth to reach arterial temperatures.

With CBW, the maximum heat gained by a hypothermic casualty from breathing air at  $41^{\circ}\text{C}$  100% RH appears to be quite substantial (Table 1). When compared with breathing ambient air at  $1^{\circ}\text{C}$  in 3 l/min there is an overall gain of 9.4 kcal/hr at a VE of 3 l/min and 23.7 kcal/hr at a VE of 10 l/min. The CBW figures, however, must be related to the potential body warming capabilities in order to assess their possible value for treatment in the field.

#### Extent of body warming with CBW

The few reports on the use of CBW in the field are inconclusive. No casualties suffering from severe hypothermia ( $T_b$   $32/35^{\circ}\text{C}$  or lower) have been treated and those that have were not physiologically monitored. It is possible, however, to predict the warming potential by simple calculation. Some examples for 'whole body' and 'core' warming are given below.

**Whole body** — for a 70 kg (21 stone) man the heat required to raise  $T_b$  by  $1^{\circ}\text{C}$  (mean specific heat of body mass 0.8 kcal/kg) is approximately 56 kcal. Some workers believe that with CBW the 'core' is selectively warmed, rather than body as a whole, but it is difficult to define the limits of the 'core' or exactly what degree and tissues it comprises and whether or not those would be warmed at similar rates. From the thermal viewpoint, heat flow in the body follows the internal laws of physics — a fact well shown by Golds and Harvey (1971) in their study of heat flow problems in relation to the 'shir-

drop' — and it is not clear how the 'core' would be selectively warmed without establishing progressive heat gradients with the rest of the body, including the 'shell'.

'Core' is usually taken to comprise 40 per cent of the body mass. To raise the 'core' temperature of a 70 kg man (core  $32^{\circ}\text{C}$ ) by  $1^{\circ}\text{C}$  would require approx. merely 22.4 kcal.

The effectiveness of CBW in raising the  $T_b$  of a hypothermic casualty ( $T_b$   $30^{\circ}\text{C}$ ) compared with spontaneous respiration at 3 l/min in ambient temperature ( $1^{\circ}\text{C}$ ), would therefore be CBW at 3 l/min—warmer — overall heat gain 9.4 kcal/hr for whole body—warming rate of approx.  $1^{\circ}\text{C/hr}$ .

for 'core'—warming rate of approx.  $10^{\circ}\text{C/hr}$ . CBW at 10 l/min—warmer — overall heat gain of 23.7 kcal/hr for whole body — warming rate of approx.  $10^{\circ}\text{C/hr}$ .

for 'core' — warming rate of approx.  $10^{\circ}\text{C/hr}$ .

#### Operational Considerations

The calculations on  $T_b$  in hypothermic casualties using CBW show that it would take several hours to raise the  $T_b$  of the whole body, or even the 'core' by  $1^{\circ}\text{C}$  or more. Even with excellent ventilation — using an Ambu bag or other equipment, which would introduce an additional operational handling requirement — it would still take 1-2 hours to obtain a  $1^{\circ}\text{C}$  rise. When other operational considerations or other complications, such as asphyxia or apnoea etc., are added it is likely to be even less effective.

Cautions issued by competent senior staff of the Royal Navy, RAF, Coastguard or RNLI are normally followed and insulated against further heat loss by blankets and covers, while hot drinks may be given if the casualties are conscious. Special warming bags may also be



available, and spontaneous circulation can usually be taken into a water heater's safety or into a vehicle exhaust. The only major heat loss should therefore be respiratory and, as shown in Table 1, the balance of body heat will available for spontaneous rearming is a major proportion of the total. Even if the balance is as low as

10-11 kcal/hr with the T<sub>a</sub> around 30°C the heat balance should be sufficient to sustain and maintain a slow rate of T<sub>b</sub> with a gradual increase in heat production. This should be sufficient to prevent a dangerous rise of body temperature to a level at which ventilation disturbance becomes a prime concern.

Table 1

T <sub>b</sub> °C	Swimline depth	del. T °C	SB	Net heat loss (J or kcal/hr)		
				Respiratory	Swimming	E (SB)
37	5	23	34	- 6.8		8- 9
37	6	23	34	- 7.8		8-10
37	10	23	34	-13.3		8-13
37	5	0	35	- 8.0		10-11
37	6	0	35	- 9.4		10-13
37	10	0	35	-18.0		11-14
30	5	23	36	- 3.0		4- 6
30	10	23	35	- 6.8		11-13
30	5	0	37	- 3.3		8-10
30	10	0	37	-10.6		11-15
30	10	30(24) <sup>a</sup>		+ 0.0		
30	10	30(31) <sup>b</sup>		+ 3.1		
30	5	30(24) 41		+ 6.2	0.0	
30	10	30(24) 41		+26.5	21.7	

S = heat recovered

E.g., heat required to maintain inspired air above heat loss on expiration

Net heat loss

heat required to maintain inspired air above heat recovered

(E) = overall gain

E = difference net gain plus the computed net heat loss at 2 l/min ventilation in air at 0°C

"

exposed to water 30 with circulating blood's ability at ambient temperatures 0°C and 30°C

SB levels

normothermic	5 l/min vent'n	1	30-40	30-40	30-40
"	"	"	"	"	"
"	10	"	"	"	"
hypothermic	5	"	"	"	"
"	10	"	"	"	"

The temperature inside modern rescue craft built in RMLI facilities in an sea rescue launches can be maintained at 20-22°C or higher even in severe weather. The temperature is ideal for preventing spontaneous rearming in both body and respiratory heat loss are minimised (Table 1). Temperatures should drop may be even further, and it would be useful to have data on the interval requirements of civilian and Service helicopters.

If the  $T_{re}$  of a casualty is above 35.0°C, shivering will be present and spontaneous rearming satisfactory in a warm refuge unless there are other complications. The value of heat production by shivering is probably underestimated at low body temperatures. Golder (Farnborough HSB) reported severe shivering in a man who fell from the Solent with a  $T_{re}$  of 39°C (prior to admission to hospital). This would suggest that shivering may be significant at  $T_{re}$ 's well below 35.0°C and this metabolic heat may be considerably higher — even at very low  $T_{re}$ 's — than is generally supposed. A major advantage of simple spontaneous rearming is that it does not require any sophisticated equipment or continuous assistance, and handling and movement of the casualty are minimised.

A recent paper of comparative interest (Gibson and Hagström, 1978) shows that other techniques of central body rearming may be of considerable value. Their data shows that with personnel drenched, even when circulating fluid is 42°C the  $T_{re}$  of a deeply hypothermic person in hospital can be raised by 4-6°C/hr. The rearming of a casualty in the field at such a rate by any medical means, even if possible might create a variety of physiological complications.

The recent Symposium at Farnborough (Farnborough 1978) in press) showed a wide consensus of agreement among wild water specialists that CB&W in the

field using warm blankets is useful for a few hours. — less than 1°C/hr rise in  $T_{re}$ .

It is questionable therefore, whether a hypothermic casualty would derive any significant benefit from CB&W during the relatively short (about 1 hour) period a rescue craft, compared with careful attention and protection to prevent spontaneous rearming. The small rise in body temperature likely to be obtained with CB&W do not appear to justify its inclusion should rescue craft for purely rearming purposes. On the basis of these operational and medical considerations, the RMLI which sank over 1,800 rescue crafts per year, arguments for a large proportion of present-day coastal rescue work, has decided not to introduce CB&W equipment aboard its boats.

Finally, although the present work has resulted in a capsule recommendation for the use of warm blankets or CB&W equipment in the particular situations considered in this paper, work is continuing on possible alternative uses of such equipment (as in oxygen), with heated blankets, by doctors or trained para-medics in life support or surface craft for other casualty conditions.

#### Acknowledgements

The author gratefully acknowledges the assistance given in the design and construction of the various modifications of the CB&W equipment by the late Mr Frank Smith, Mr Ralph Galt of the Department of Medical Physiology, Edinburgh University; Mr Norman Burns of the Department of Anaesthetics, Royal Victoria Infirmary, Newcastle upon Tyne; and Dr Philip Rogers and the workshop staff at the Admiralty Marine Technology Establishment (Physiological Laboratory), Aldershot.

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## Sealex Phillips S.S. (Sealex-Submersible) Service Vessel

R.J.W. Adamson and M.J.D. Fitzgerald

### Introduction

The problems associated with diving for oil in the North Sea are many and varied, not least among them are those of surviving and maintaining the 'legs' and 'tail' beds. In addition, the adverse weather conditions in the area provide a constant threat to the safety of personnel on the rigs and have on a few occasions in fact overwhelmed these modern technological Colossus.

It is now commonplace to try and read about oil rigs on the television screen and in the press. With their everyday operations there have been the dangers that accompany any industrial process, in this case oil leakage, fire and penetration of countries and any one of the other one hundred and one hazards of most sport or war.

Several years ago Mr Walter Eberington and his associates of the South Eastern Diving Company (SEDCO) and other concerns, among them Mr Ted Adam of oil fire fighting fame, conceived the idea of having a large service vessel which would have the capability of providing routine maintenance facilities as well as acting as a rescue and hospital ship in addition to co-ordinating any emergency disaster control.

The choice of a semi-submersible rig was at the time a unique solution which led other major oil companies to consider similar vessels. They have a distinct advantage over conventional hulls in that they are able to operate more effectively in adverse weather conditions and provide a more stable and secure operation from the

operation. The only disadvantage in comparison with conventional hulls is that in a storm state, with the buoyancy adjusted to give maximum drag, its speed is still relatively slow. It is, however, adequate for the design purpose.

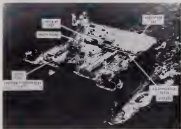
### The Test

Mr Walter Eberington, Vice President of SEDCO, invited the authors to accompany a group of interested oil rig operators on a scheduled tour of the new vessel on December 3, 1977.

SEDCO arranged for a charter flight from Houston at 0700, arriving at Savannah around 1000. From Savannah there was a short transfer by 544 helicopter to the Phillips S.S. as another 544 flying out both as a service call. As we approached to land on the helicopter deck, she provided a landing pattern in the clouds and her fire fighting capabilities with her big monitors in action. About four hours were spent on board, in which time we were shown the many interesting and novel features of the vessel by the very helpful guides.

### The Vessel

Phillips S.S. is the first vessel of its kind produced specifically for use with oil rigs and encompassing a wide range of facilities (Fig. 1). At a cost of \$40M the 1,800 ton robust submersible semi-submersible safety vessel has its buoyancy provided by two oval hulls and eight stability columns, of which four are large and four are small supporting a rectangular main deck on



which living quarters, refrigeration, equipment and control units are placed. The crabs are raised by a system of trawls. The propulsion machinery contained on each hull is of a conventional propeller and stern nozzle unit and a thruster of an azimuth type forward. There is provision on the hulls for bottom fuel oil and pump rooms. By means of eight anchors, two per water stability column, the vessel can move slowly, maintaining accurate position if necessary by using thrusters when in a damage control or repair role alongside an oil rig.

The vessel has overall dimensions of 112 feet long by 240 feet wide with a main deck some 90 feet above sea level of 234 feet long by 197 feet wide. At the after end of the main deck is a two-story accommodation block, the deck house wing which is a full red. This deck house also houses the after control position. For fire fighting there is a forward control position.

In an emergency the vessel is capable of some 3 knots, this can be increased by the use of thrusters assisting the main propulsion units and with the help of tug. Fuel capacity for a normal three months North Sea operation is 280,000 gallons in the lower hull.

The vessel was built by the Mitsubishi Heavy Industries, Shipyards at Hiroshima in Japan and was delivered to EDDCO in June, 1977 for its passage of 16,000 miles to its first oil berth near Stavanger at the end of November 1977.

#### Functions of the Vessel

1. Platform, jacket and main inspection of oil rigs
2. Assisted servicing and repair of off shore production facilities
3. Support of off shore pipelines and its repair
4. Supportive fire fighting, construction

activities, workshop facilities, hotel facilities, repair services using associated medical facilities, communications including helo.

On our tour around the ship the following (in no particular order of merit) were noted:

**Lifting capabilities:** One major crane, a Clyde model situated in the midline forward, capable of lifting 50 tonnes loads depending on stability in use and nature of the crane and the conditions and associated vessel movement can to some extent be offset by increasing the draft to 60-80 feet instead of the normal 18-20 feet on the hull, which effectively reduces ship motion even in significant wave heights of 12 feet. In addition there are two 30 ton Borman Ever Ma 100 cranes with 120 feet booms.

**At-sea Ship up and to station:** at the main crane provides with its neighbour ship deck space, a safe for repair of areas lifted on board using the repair equipment in the machine shop.

**Work on popliteal:** Inspection is carried out by use of constant tension popliteal clamps with a work platform in use in the inspection and assembly of sections of pipe. Water and air pressure is also available to expose lines of popliteal on the seabed.

**The diving package:** capable of 24 hours a day continuous shallow water and saturation diving operations, is the 14 specialty of a separate diving contractor. It is situated on the main deck forward on the starboard side of the big crane, permitting the diving bell to be lowered adjacent to the platform used for inspection associated to the preceding paragraph. The saturation diving complex is completely self-contained with provision for feeding, showers, toilet and sleeping during diving operations and subsequent decompression. There is a spirometry system monitoring all diving gas mixtures and full electronic analysis and display of results. There is a

closed circuit TV display, communications and entertainment link for the divers. Additionally, there is an emergency compressor unit for divers on the main deck apart from and independent of the main diving chamber of the complex.

**A two-storey deck house** (accommodation block), on the midline at the star end of the main deck, is surrounded by a helo pad. This can take a Sikorsky S-40 helicopter. Controls and communications are housed on the upper deck of the deck house and the area corresponds to the bridge on the normal ship. The deck house has 150 berths, though normally only 90 are occupied. Hotel services include recreation space, conference room, galley, mess room for 44 people at one sitting, a bar/pub and a lounge.

**The Hospital:** This consists of a large open area containing no beds of permanent and folding type on the periphery of two of the four sides of the rectangular open space opening from which are three cabins equipped with sliding doors and each containing four beds, to give a total of 18 beds. The whole is soundproofed against outside machinery noise and the same type of soundproofing.

The hospital is situated on the port side of the lower deck of the two-storey deck house and adjacent, yet more cabins which can be used for patients of various areas. Access to the hospital is gained by stairs and passageways for ambulant patients, or by way of a short passage from the main deck where a liner could be easily lowered from the helo pad by use of a crane.

Captain's space appeared adequate for "emergency use" stores. An examination couch of rather short dimensions, with an overhead theatre light, was available in the centre of the open space in the hospital, and there was immediately free access to a lounge from the main house with viewing glass top. The open space could also be used

for reception of casualties and as a meeting room.

Reanimation equipment included Flapton with an attached ventilation facility. The "Meds" has an emergency bag for dealing with accidents on board.

We thought the following points should be considered carefully to improve the very limited life-line experience of the hospital. They are mentioned only briefly and discussion will be included in any provision of equipment by the Medical Advisor of SEDCO, bearing in mind the cost and likely use.

The existing restaurant usually, with its built-in shelves, could with advantage be moved to one side and replaced by a simple wooden operating table. Operating theatre accessories such as a Boyle's machine and anaesthetic gas cylinders would be needed for contingency use as well as standard anaesthetic drugs and consumables. There is a need for some form of screening to isolate the operating table when in use. An anaesthetist or similar standing unit is required in addition to previously prepared packs of sterile instruments, dressings, towels, gloves, and special emergency resuscitators, cut down sets, urine etc., disinfectant etc, etc.

Consideration should be given to the provision of a portable X-ray machine and developing facilities, an electrocardiogram laboratory facilities including a microcassette for sample tests in addition to cross matching and blood grouping (blood flows from where is required should be kept as a safe cool container until received, although it is not intended that this facility should function as a blood bank).

Adapted drugs and provision for the safe keeping of "Dangerous Drugs" are required. The need for first aid cabinets on board at other strategic points should at least be considered.

### General Remarks

Many of the points mentioned above are already being considered. Previous depends on an assessment of cost and the projected use of the vessel. The experience must be one which will not necessarily deteriorate rapidly. The facilities will without doubt require an enthusiastic Medical Advisor and "Meds" two only met the Meds and he seemed to be competent and enthusiastic, consistent with the few points we mentioned.

It is of course recognized that it would probably be good policy to exercise long stay patients in their state as and when convenient. However, in the event of a disaster involving many injured casualties, when perhaps help from outside would be needed. "Medics" on other rigs in the neighbourhood could be transferred and medical/surgical teams could be flown from shore.

The use of the ECG and portable X-ray is within the capability of the "Meds" and trained helicopter crews could take ECG tracings and X-rays where for sending as required.

Consideration is also needed in order to obtain back up by arrangement with a hospital with CS&D facilities for safe and efficient shipping of ready made sterile packs already mentioned.

This was a well worthwhile visit to a novel facility. In our unit, from our point of view, its medical use should prove an interesting subject for a future article.

### Acknowledgements

The help of Surgeon Commander J W Davies and P W C Dolder in writing this article is gratefully acknowledged. The discussion is provided by the courtesy of Mr P W Ross, RSM and the staff of MEDICAL Support Group.

The visit to the Phase 2.5 was arranged through the courtesy of Mr Walter Etherington, Vice President of SEDCO to whom acknowledgement is gratefully made.

## What Shall We Do With The Drunken Sailor?\*

Andrew C. Smith

The Dronelouga Seamen's Hospital in Greenwich is an old fashioned institution, in the best meaning of the adjective. It has a purpose, caring for sick merchant seamen and it does it pretty well, so that the process seems by the place. The staff is helpful, there are chaplains, chaplains and interpreters when they are needed, and there is a medical lady who is a type before rather than a social worker. The buildings are old, however, and shabby, and one first looks a fine specimen of Victorian blue and white sanitary ware and brass plumbing. Some of the patients refer to an experience as having a roll to dry, duck and they take the opportunity "while I am here" to have their teeth looked at, sight tested and even cut. Patients may be longer than average but they are never bored waiting for somewhere to go, because they are used to long years of empty time, and in the ward they may stagnate from years back and exchange many a year. The ward is an institution of a few years ago and devoted to the social nature of the patients who were a nursing officer to sight. It is as if the last few years had never happened, and of course the Dronelouga is now threatened with change to save money, but that is another story.

The women home to from all corners of the globe or roll into country from the pub across the road (just 3 pm appointments turn up at 2.45) having pub-crawled from the moment in the last kind. At the hospital people are admitted again and again merely for being so drunk as to be ill, only so long as they are women. Alcoholism outweighs all other causes in the psychiatric service. The staff is available day-long everywhere, and has some merely the knowledge to walk down the stairs a long way just up constantly saying "I don't see you get through a bottle of spirits a day". Because the women is so often higher than it's difficult to object questions to ever higher patients. "Dry" days may mean out to be there that often it than it is and only has one story.

As a result a boy can become alcoholic in his own room after going to sea. Some of the people have additional vulnerability to addiction through their unhappy and disturbed personalities, being given to see after failing to get on with people ashore. I have also met plenty of people, now middle aged, who were brought up in the home Navy-organized as phlegm, and who when 14 years old were told to go to sea, with no permission to discuss the pros and cons of wandering across the world for a living.

There are different patterns of drinking problems with different seamen. Some drink heavily to see where the drink is cheap and there is, they say, nothing to do

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*Inventory of Mary Queen Picture Library*

Oring where they make for home will remarkably often in Scotland, and spend a quiet respectable leave with their families, drinking only socially. Others have the problem the other way round. They feel satisfied on by working hard, finding the job interesting, making their own business and "turning out" after their watch. This is their way of life where they have a mate and are wanted, and there are never as trouble with their superiors. When they pay off as Robertson or a home port, however, they have hundreds of parents in their pockets and no family, and then literally nothing to do and nowhere to go. They go to the common to lodge, and start drinking with old shipmates. A party becomes a binge, then a bender, then a line weekend, and finally they are alerted for "Mop-up tour" at the Dendrograph. Asprake returns to their ship, sleep free of symptoms takes rather longer, and a few two or three weeks we see a lot of sailing men who are pitiful

and looks for his own ship. He will usually try and ship out almost directly from the hospital, again to save the world. There are plenty of such people who have to be dried out after being susceptible of and who more or less realize that they are alcoholic and so don't trouble. Hardly do they want further treatment, however, and on returning to sea they often work for a few years again before their stress builds up to such that they make themselves ill while at home, making themselves. These admissions are minimal and a cheap use of public facilities for quite a good return.

The symptoms of the suffering life have no doubt that DDTs in office caused by wearing out huge doses of regular alcohol, because the symptoms happen when men ship out on a day for fairly dry vessel after a drinking spree of three days. DDTs can be standing on board ship, and under duress. I recall a man who jumped overboard in mid-ocean when the

hallucinatory voices told him so. He was saved when the ship turned back and fished him out, and he was kept in water for the rest of the voyage.

One well known reason for being taken home is a psychosis independently from foreign ports: "hans strike" contracted on the Persian Gulf. This life on the islands tied up there is immensely boring, there is nothing to do when the boat is at anchor and usually dry — and it is hard by some to be necessary to drink a huge quantity of twenty cans of beer a day to stay sober. Under these conditions I find that alleged hant strike tends to display the clinical picture of severe confusion, disorganised delirium, nightmarish hallucinations, and frightening visual hallucinations, often of menacing birds creatures.

One marine surgeon presented me with a variation on the delirium of the alcoholised engine driver. He was coming down to the world and had not been to sea for a while, instead he had a curious underground existence with the Free Welsh Army, which was described to me as a drinking club. He was suffering a replacement delusional illness which probably started as an alcohol syndrome but later appeared to be schizophrenic. He agreed to an informal admission and came to my attention when he had the most startlingly delusional ideas of red and green lights — any red light represented a sign from Mao Tse Tung and the communists (his last command had been flying between Hong Kong and China) and any green signified the ascendancy of Mr Heath. He responded to the ward round that after some telephone calls he had secured a ship and was setting up Channel from Southampton that evening. He demanded to go, and when it showed reluctance to permit it, he squared up to the nurse. I added to them to let him go and off he went down the dore. He had his discussions with him all in order. This was eight years ago, and at the time there were

three weeks work in the base off Falkland, started by his body. I got on the 'phone to the Shipping Information division.

There are secondary routes downhill for those in decline from drink. These will almost certainly be found in those in ongoing work. Unemployed seamen, stewards, and cooks have to leave the shipping employers' "port" and offer themselves abroad. They can still work for Panama and Liberia. This year I met a character 60 years old, Scottish, spent no time as he pursued a great career in communications, working as chief engineer on the Brazilian coastal trade, though his memory was so impaired that he had no idea of his own age to within five years and, even when sober, could not multiply two numbers together. The bottom of the shipping stage is back home again, working the dredge boats on the Thames, but in the March they are work and back the next. Drink on your day off induces back to the ship somehow by the time of your next to sleep it off and start the trip again.

All conditions run up their own totem, including a fair number of disturbed personalities and plenty of homosexual networks, but the other psychiatric syndrome which is really typical of the individual Navy is the "head trip". This has nothing to do with LSD but refers to a voyage with an impossible atmosphere, at least for the patient. A married 40 year old man had to visit the consulting room, slightly reluctant at being sent to a psychiatrist before he can get his job back. He knows he is no nut case. He is preceded by a letter from the employers' doctors asking for advice on whether he is suitable on psychiatric grounds to return to sea, and describing the extraordinary way he behaved on the last trip, sometimes work excursions from the captain's log and cables from remote ports. He may have begun to withdraw from his shipmates and fade on his cabin. He may

have begun to think he was being poisoned. There may have been violent expressions of resentment against the officers, captain, chief steward, bosun or chief cook, flight, who sat alone in the cabin, murderous threats uttered when he was down. None of these things worried others than it worried so much as his only no pump continued.

Such a man may become completely confused and "shattered in personality" and be put ashore for the safety of himself and of others. He may receive drastic treatment in up over South American hospitals, where he can speak English, or in Spain from men who, despite their glib calling, translate him to the land lord. Under these conditions emotional equilibrium is close to nature, even off the ship where the story started, and several weeks later, after much time for thought, the unfortunate may reach me. He then describes quite simply his bad trip: how the human atmosphere was, for him, the worst he had ever encountered, how he discovered bad equipment and useless

instruments, how his superiors were wholly fit—and he got the blame for a hold-up really caused by cargo shifting—and so forth. In single words he set so much and up so much for each other, but the most important is the complaint.

A few men qualified together for a long period without chance of escape and not having chosen one another as companions in the first place, what great trouble has not arisen about the persons that build up ships? When the man breaks down it is not into any particular pattern. Anything can happen and frequently does. And it happens almost in spite to the world in its entirety. The separate circumstances or errors for that individual does it, and when it is over it can usually be traced to forget the modest and routine work as soon as possible.

These men were truly alone too.

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*The problems and problems of Gull's Adventure  
for us. 12*

## LETTERS TO THE EDITOR

Sir

It is now some years since I wrote anything for the *Journal of the Royal Naval Medical Service* but I have written a paper<sup>1</sup> summarising a series which showed the increase in sugar consumption in the U.K. and that formed the basis of a book I wrote on the refined carbohydrates. So I was naturally interested in the recent paper by Morris, Thom and Shallick on "refined carbohydrates and urinary excretion".<sup>2</sup> When medical specialists for the Queen Review came some years ago, I had a great deal of experience in the subject, but I am afraid that my recommendation has now become rather old fashioned.

However, as the first article by these authors, they do not seem to think that they may well do as they now would: that *cereal* (includes in this a natural disease but, as I believe a very prominent one, based on the excess of refined carbohydrates, especially sugary ones.

Thus, as Morris, on a natural diet, the urine is seldom highly acid, as it often is today, with the diet now largely comprising refined carbohydrates and others containing refined sugar so that urinary calculus seldom occurs as primitive races living on their natural foods. For instance, today in those islands the urine often becomes markedly acid so that uric acid and urates are sometimes precipitated, which they would not be on an alkaline urine. Thus, after eating a green apple, like the delightful but now Gristley Smith, the urine

becomes alkaline, not acid, as mentioned, which shows the desirability of natural, as opposed to refined and often sugary, foods in our diet today. That is why I place much stress in the mentioned group of diseases due to eating these more refined foods.

I should like in this note to refer to the current marketing of all British processed preparations, including processed bread, but foods. These can be made very delightful by flavoured them with sugar and hardening them to a crumbly state, but the result in my opinion will be that these sugar flavoured particles will then be broken by the stomach into the elements of the tooth so that a serious dental decay can become initiated, unless extensive and rather awkward cleaning procedures are undertaken directly afterwards.

I myself introduced the taking of bran to regulate the action of the bowel when serving on the *King George V* during the last war, and for many years subsequently (especially in the treatment of diverticulitis) in naval hospitals, but I am very careful in chapter III of my book "*The Saccharine Disease*"<sup>3</sup> to point out that the bran recommended throughout was unprocessed bran, i.e. bran in its natural state.

In the above chapter I also point out that the Bible, in the 14th chapter of Leviticus, emphasises that the difficulty with the bowel is liable to be permanent in old age, as, in Leviticus, part is so literally, "where the sound of the

opening in the floor when the water full up in old 1923 the door shall be shut on the street."

The riding of unprocessed beans, which in the Navy was helped by eating it in half a cup of water, can be helped today by using it as milk, but I submit that any recommendation should be issued by eating a dried fig or some sugar, so as to avoid any eating of refined sugar, and I submit that medical officers should carefully note this point.

It is surprising to read in a recent article in the Daily Telegraph of June 21 that in Brazil, where sugar is grown and much refined sugar eaten, some 20 million Brazilians had new toothaches.

Anyone interested in this preventive step could well correspond with Lord Cliff OBE, FDS RCSI in Surgeon Commander (R) who has now left the Royal Navy and lives at Pine Cottage, South Green, Southwold, and who has made a penetrating study of this matter.

I am, etc.,

**T. L. Clarr, FRCP**  
Surgeon Captain - RN (Retd)

#### References

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2. Moore J. E. B., Bellin A. (1956) *N. A. & Hawthood, N. J. (1955) (Navy Medical Officer) and the Navy Medical Service Journal of the Royal Naval Medical Service* 12: 103-115
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"Goffin" is a noun in from the French 'Gouffin', i.e. to waffle, hokumish of Confessions, an animal of several different species. The name was originally given by French writers to many harems owned from their haremkeeping the earth in Canada and thence the name was given to a grey harem-keeping squirrel (*Sciurus hibernicus*) west of the Mississippi to S. Richard Ross, and in Wisconsin to a grey squirrel. In Missouri a common species is a peacock rat of a reddish colour with broad mole like furrows, the Gouffin harem-keeping. In Georgia a snake (*Coluber Conspicua*) is called by the same name, and in Florida a turtle (*Testudo polydactyla*).

But there are other possibilities — Gouffin, a loud burst of laughter, harem laugh or perhaps more appealing, Gouffin, an old fellow, an aged name (contracted from Confessions of Gouffin), 'Go to such Gouffin and such Gouffin'. Gouffin was originally a word of respect, now deprecated into a term of familiarity or contempt when addressed to an aged man.

Gouffin (gouffin) — an iron hook with which men use pull great fish into their ships.

I do not think Gouffin of Prov. Eng. Gouffin — 'to talk vulgarly and loud, to speak in groups, pretend, pretend (talk)' applies, or would be appropriate.

But it is certain that if you cannot take a joke you should not have posed.

I am, etc.

**S. Freshman**  
Surgeon Commander RN (Retd)

Sir,

The Journal has been called the 'Gouffin Gouffin'.

This subtitle has been a puzzle to me, a preferred suggestion is that

Sir,

It is indeed very sad to note that no demonstration was put up by the RANM

Officer, was asked by my Service medical officer, at the last meeting of the Royal Society of Tropical Medicine and Hygiene.

Has the incidence of the DeLancey Forces Medical Officers in these areas declined (as dangerously low)?

Will the time come when we will be called upon and be found wanting, like foolish rogues?

Yours, etc.

**Karlwald E. Vella**  
Colonel

Assistant Professor of Pathology  
Royal Army Medical College, Millbank

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Sir,

Here I, through you, give my sincere thanks to all those readers of the Journal who so kindly and generously contributed ideas to my retirement portrait. I was quite overwhelmed by such magnificent gifts.

I always felt so fortunate and privileged at being allowed to do, for so many years, a job I enjoyed, with people I admired and in a place I loved. The gifts, therefore, were truly an additional bonus.

I am very much enjoying a busy stress-free retirement but there are still not enough hours in a day and the weekends come round all too quickly just as they always do!

I would like to wish my successor, Joan Williams, and all concerned with the production of the Journal a long and prosperous future.

Yours etc.,

**Joan Reynolds**

*A further letter to the Editor appears on page 492*























